The influence of immersion and personal relevance on coping responses after virtual flooding experiences

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The Influence of Immersion and Personal Relevance on Coping Responses after Virtual Flooding Experiences

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Master of Science
in Human Technology Interaction

Supervisors:
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Dr. Jaap Ham

Preface

Choosing the topic for this master thesis was a fun and relatively smooth experience. I tried to choose a different topic for all of my projects throughout my master program to gain a wide variety of knowledge in the interesting field of Human Technology Interaction. The general topic of my thesis would be Persuasive Technology. Because research is often open ended and needs more iteration of experiments before reaching conclusive, valuable insights, I chose the challenging, more specific subject of Virtual Flooding Experiences.

The goal of a virtual flood would be to persuade users to better prepare themselves for real floods, however, based on previous research, it seemed that just making the simulation more realistic was not enough. This was where emotions and personal relevance entered the picture. I believed that we could provide valuable new insights if the flooding simulation would become more personally relevant it would greatly improve the previous research. It isn't just *a* house that flooded, it is *your* house. It isn't just *some* animal that drowned, it is *your* pet. Because the Netherlands is and will always be a flood prone area, but nobody really realizes this in daily life, this seemed like a great project to also create some extra awareness.

At the same time I started my experiments, large parts of Europe flooded. Germany especially was struck by heavy water damage. Many participants and friends asked whether my research was directly related to that specific flooding. This actuality made me feel even more aware of the importance of this research. A few years ago climate change was a popular topic. However, even though it is still happening, attention to this subject has greatly diminished. With this research I can bring some of that attention back, and even help to suggest a possible solution to further create awareness among European citizens.

As I could not have done conducted my experiments and could not have written my thesis alone, I would like to thank Cees Midden and Jaap Ham for their supervision, Martijn Willemsen for his assistance with MouselabeWeb, Martin Boschman and Aart van der Spank for their assistance with setting up the experiment, and Ruud Zaalberg for sharing the questionnaires from his experiment. I would also like to thank all who helped to review my work, and my boyfriend and family who supported me throughout this project.

Summary

This research investigates the determinants of effective user persuasion in virtual environments. The main research question is whether and how immersion and personal relevance influence future coping actions and emotions towards floods. A high level of immersion in technology leads to a high feeling of presence. For people who have experienced a flooding, emotional damage has more impact on their future coping actions towards disasters than do material damage or property damage. People who have felt emotional damage seek to protect themselves by better preparing for future natural disasters. Knowing this, it would be helpful for all people in flood prone areas to experience a flood first-hand. Of course, it would be unethical and uneconomical to arrange actual floods. Therefore we decided to investigate if the same impact can be recreated using a virtual environment. We investigated whether people experience presence in a virtual environment, and whether they feel personal involvement. Immersion was induced in two ways, by using either a slideshow with still images, or an interactive game simulation. The level of personal relevance was induced by either a personal or a neutral story being narrated. We expected that (H1) a higher level of immersion and (H2) a higher level of personal relevance would increase the feeling of presence and personal involvement and would in turn lead to coping actions. We also expected that (H3) personal relevance would have an effect on coping actions when immersion is low, but that personal relevance would have the greatest effect on coping actions when immersion is high.

The results support the hypothesis that higher immersion improved the feeling of presence. However, this increased feeling of presence did not lead to an increase in coping actions against floods. In addition, participants who experienced the higher personal relevance condition reported more understanding of existing measures to prevent floods, in this case increasing taxes and widening rivers to protect the Netherlands. Thus, the relation between immersion and personal relevance is not as simple as “more immersion and more personal relevance leads to more coping actions.” This research suggests that both less immersion and a more personal setting, and a situation with more immersion and a less personal setting led to more coping actions. More immersion and a more personal setting led to less coping responses than more immersion combined with a neutral setting, which is opposite to our hypothesis. Thereby the current research shows promising results for low immersive and

personally relevant applications in virtual flood experiences in order to promote self-protection and coping actions in case of real floods, and more research is advised on a highly immersive and personally relevant application.

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1. Introduction

Climate change leads to an increase in natural disasters, or may magnify the impact of natural disasters. In Western Europe one of the most prominent forms of natural disasters is flooding, such as the floods of May and June 2013 that occurred in Germany. Floods are a real threat, and can lead to huge costs and material losses when companies and residents live in or invest in flood-prone areas (Klijn, van Buuren, & van Rooij, 2004; te Linde, Bubeck, Dekkers, de Moel, & Aerts, 2010; Bouwer, Bubeck, & Aerts, 2010; Jonkman, Kok, & Vrijlig, 2008; Feyen, Dankers, Bódis, Salamon, & Barredo, 2011).

Figure 1.1 Houses in Passau, Germany is flooded because of high water levels of the river Donau. **AP / Armin Wiegel www.nrc.nl**

Citizens in flood-prone areas often are not aware of the risks and feel protected by dikes and drainage systems. They have a false feeling of security. When a flood occurs, they are often unprepared and expect the authorities to provide proper protection and compensation after a disaster (Botzen, & van den Bergh, 2008). If citizens were more aware of flood risks, they would be able to better prepare themselves and protect themselves against it (Wildavsky, & Dake, 1990). When people have a direct personal and emotional experience with floods, they better understand the potential danger in the future and tend to adopt proper coping actions (Zaalberg, Midden, Meijnders, & McCalley, 2009; Kreibich et al, 2005; Gutscher, 2008). For this reason, it could be beneficial for public safety if all inhabitants of flood prone areas could experience a flood. This, however, would not be desirable and might even be unethical.

A possible alternative for a real flooding experience could be a virtual one. Zaalberg and Midden (2012) demonstrated that a virtual experience of a flood affected users in such a way that they tended to adopt coping actions to deal with real floods. Because emotions are an important factor in coping behavior after a flooding experience, we expected that people would feel more involved with the flooding simulation if it were made personally relevant. Zaalberg and Midden (2012) believed that adding personal relevance and emotions to an immersive simulation would significantly increase users' adoption of coping actions to deal with real floods. Therefore, we extended Zaalberg and Midden's research and investigated the impact of adding a heightened sense of personal relevance to the flooding simulation.

This report is structured as follows: First we discuss how the feeling of presence, emotions, and personal relevance influence how people feel about virtual realities. From this we will derive three hypotheses about the link between presence, personal relevance and coping actions. Then our methodology is described, and our results are presented. Finally, we present the conclusions and discuss the limitations of this study.

1.1 Theoretical background

The feeling of being at risk (negative emotions) can persuade people to taking a specific action to prevent or reduce the risk (coping actions). This is valid in the real world (Gutscher, 2008), but also in the virtual world. Previous studies have demonstrated that a virtual experience of risks can influence perception and behavior (De Hoog, Stroeve, & de Wit, 2008, Chittaro, 2012, Zaalberg, & Midden, 2012). When a virtual risk is presented in a highly emotional way it has more impact on the user than when it is only factual. This makes persuasion more effective (Chittaro, & Zangrando, 2010). Persuasion in this research means to convince people to perform a specific kind of behavior as a result of interacting with the used technology: a virtual environment.

Another factor that makes virtual experiences more persuasive is personal relevance (Khaled et al., 2007). When a virtual situation is more relevant to the user, it also increases the feeling of presence. Presence is the feeling of immersion, of 'being there'. Relevance may even be more important than the simulation's degree of realism (Hoorn, Konijn, & van der Veer, 2003). In this research, the level of immersion corresponds to the level of simulated realism. Relevance can be created by using a narrative (Gorini et al., 2011). Emotions also

play an important role in feeling present in a virtual situation, where emotions can lead to a greater feeling of presence. However, a greater feeling of presence can also lead to the feeling of emotions (Bañoz et al., 2004a; Bañoz et al., 2004b; Jurnet et al., 2010; Riva et al., 2007; Alsina-Jurnet et al., 2010; Villani et al., 2012).

Presence in a virtual reality can indicate the feeling of an unmediated experience. It can be induced by including the following relevant components: sensory factors, (lack of) distraction factors, and realism factors (Mikropoulos & Strouboulos, 2004; Witmer, & Singer, 1998). The degree of experienced presence is also dependent on the user's personality (Alsina-Jurnet, & Guriérrez-Maldonado, 2010; Wirth, Hofer, & Schramm, 2012). It is even possible to feel more present in a virtual situation than in a real one (Villani et al., 2012). Presence consists of three dimensions: spatial presence, realism, and involvement (Zaalberg, & Midden, 2012).

1.2 The current research

Earlier literature has shown that it is possible to mimic a real risky situation in a virtual environment, and induce the same type of persuasion as a real risk would. The virtual situation should induce emotions and it should be personally relevant to achieve the desired outcome. The feeling of presence is an important aspect of a virtual environment's effectiveness, in which realism (the level of immersion) and involvement (personal relevance) play a significant role. Prior research on virtual floods shows that the feeling of presence promoted to the desired coping actions (Zaalberg, & Midden, 2012), whereas empathy did not (Snoep, 2008). Snoep (2008) presented participants with a video of the floods which occurred in 1953 in the Netherlands, but found no increase in adoption of coping actions.

Our literature study showed that the influence of and interaction between levels of immersion and personal relevance have not been investigated as determinants of response intentions. This leads to the following research questions:

What are the influences of immersion (high vs. low) and personal relevance (high vs. low) in a virtual environment where a flood occurs, on people's sense of presence in the virtual environment and on future coping actions towards floods?

In line with Zaalberg & Midden (2012) we formulated Hypothesis 1:

H1. The feeling of presence will be larger when the simulation is more immersive. This will create more active involvement in the simulation, and this will result in searching behavior for coping actions for future floods.

Although Zaalberg & Midden (2012) previously investigated the hypothesis above (H1), our next hypothesis (H2, below) is a novel one. We hypothesize that both personal relevance and emotional involvement influence the feeling of presence, based on Bañoz et al. (2004a, 2004b), and Gorini et al. (2011).

H2. The feeling of presence will be larger when the simulation is more personally relevant. This will create more active involvement in the situation, and will enhance searching behavior for coping actions for future floods.

Based on Bañoz et al. (2004a, 2004b), we also hypothesize that at any level of immersion, personal relevance influences the feeling of presence. Based on Zaalberg & Midden (2012) we expect that a higher level of immersion combined with a higher level of personal relevance will lead to a greater feeling of presence and will have more effect on adoption of coping actions, than a high level of immersion or a high level of personal relevance alone.

H3. In a less immersive situation, a high level of personal relevance will have an effect on the feeling of presence and coping actions. In a more immersive simulation, a high level of personal relevance will have an even larger effect on the feeling of presence and coping actions.

To investigate our hypotheses (summarized in Table 1.1), we planned a between-subjects experiment using a 2 (immersion high vs. low) x 2 (personal relevance high vs. low) design, see Table 1.2. A low level of immersion will be created by using a slideshow, while the high level of immersion will be created using an interactive simulation(as in Zaalberg & Midden, 2012, and Snoep, 2008). We will refer to this simulation as "videogame". A low level of personal relevance will be created by playing a neutral narrative, whereas a high level of personal relevance will be created by playing a personal narrative (as in Gorini et al., 2011). We expect these to induce a feeling of presence with spatial presence, realism, and

involvement as subdimensions. We expect that this will influence the degree of searching for information, as well as future coping actions for floods, see Figure 1.2.

Table 1.1 Hypotheses

	Low immersion	**High immersion**
Low personal relevance	No effect on presence, involvement & coping actions	Positive effect on presence, involvement & coping actions
High personal relevance	Positive effect on presence, involvement & coping actions	High positive effect on presence, involvement and coping actions

Table 1.2 Research Design

	Low immersion VE	**High immersion VE**
Low personal relevance	Slideshow + neutral narrative	Videogame + neutral narrative
High personal relevance	Slideshow + personal narrative	Videogame + personal narrative

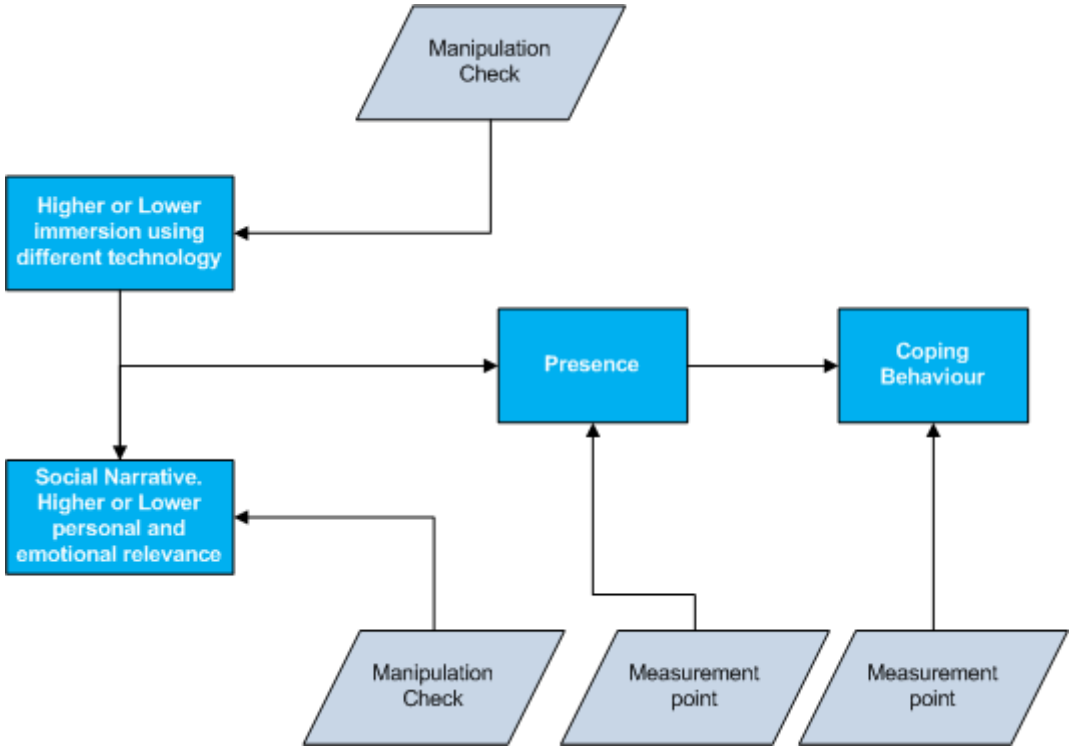

Figure 1.2 Research design with arrows

2. Method

We performed the experiment using an existing interactive 3D simulation, showing a Dutch polder where a dike breach occurs. Following Zaalberg & Midden (2012), we manipulated immersion by comparing a slideshow on a small screen with an interactive videogame on a large screen. The slideshow contained stills of the videogame. We manipulated personal relevance by comparing a neutral narrative with a personal narrative. Finally, we tested the participants' willingness to cope with future floods by using an unconscious 'searching behavior' task and several questionnaires. The following subsections will discuss this design in more detail.

2.1 Design & Participants

Participants were randomly assigned to one of four conditions, in a 2x2 between-participants design with immersion (low vs. high) and personal relevance (low vs. high) as independent variables. The dependent constructs that were measured were personal involvement, psychological immersion, and behavioral intentions (concerning coping actions towards floods).

As advised by Snoep (2008), and Zaalberg and Midden (2012), our participants were all in the same age -group. These authors encountered a problem with older participants' time to read the items in the searching for coping actions task.[1] Therefore we chose to only accept participants between 17 and 35 years old. Based on a power-analysis and data from Zaalberg and Midden (2012), we chose to use 26 participants per condition, resulting in a total of 104 (58 male and 46 female) participants. People who participated in Zaalberg or Snoep's flooding experiments before 2010 were excluded from participation.

[1] Zaalberg and Midden (2012) accepted participants in the age-range 16 to 80 years old. They wrote that older participants read questions as well as the possible coping actions more slowly than young participants. Therefore comparing reading time between different ages biases results and it was suggested to use a more homogeneous sample of participants: from only 1 age-group.

2.2 Manipulations

2.2.1 Immersion

Our immersion-manipulation is based on Zaalberg and Midden's (2012) least and most immersive experimental conditions. Participants in the least immersive conditions viewed a slideshow with still images (11 seconds per image, 4 minutes and 46 seconds long), the images were taken from the videogame simulation which was used in the high immersive experimental conditions. The videogame simulation was called Levee Patroller 2007 (Figure 2.1), which was a training program for dike inspectors. The videogame (and slideshow) started with three residences on the side of a dike. Then the participant would 'walk' over the dike, seeing a high level of river-water on one side, and a polder on the other side. The participant was assigned to walk to a ditch, where sand bubbled up as soon as the participant was close enough. When walking back, the dike breached, flooding the polder area completely. When the participant returned to the houses, the lowest house was submerged up until the first floor, the middle house had a flooded ground floor, and the house on top of the dike was not submerged. The participants in the high immersive condition could control the video game themselves. It was built with Unreal Engine, and was controlled with the computer-mouse (looking around) and keyboard (walking, ducking, and jumping). Participants in the low immersive condition did not have control over what happened. In the videogame, instructions were spoken to guide participants in the right direction.

Figure 2.1 Levee Patroller 2007

2.2.2 Personal relevance

We tried to make participants feel that the flood happening in the virtual environment either personally applied to them (high personal relevance), or did not apply to them (low personal relevance). First we manipulated this by giving participants an imagination assignment. Participants in the low personal relevance condition had to imagine what it was like to do groceries in a supermarket—this is a neutral activity that everyone has experienced. Furthermore, since this task was not relevant to flooding, we believe that this was a good substitute for the task performed during the high personal relevance condition, where participants imagined their own street flooded with water. In the high personal relevance condition, the participant had to imagine that a flood occurred and what terror happened to themselves and the other inhabitants of their own street. This was to prepare for the virtual environment.

During the virtual experience, a narrative was told. A narrative is a story describing an event. Snoep (2008) tried to manipulate emotions by adding a video before the simulation, and her results were inconclusive. Gorini et al. (2011) played their narrative during the simulation, and found significant differences between with and without narrative groups. We therefore believed that the best way to manipulate personal relevance is to play the narrative during the simulation, not before or after. In the low immersive conditions, the narratives were played during the slideshow (they were movie-files). In the high immersive conditions, the narratives were played when the participant reached a certain checkpoint in the virtual environment. These checkpoints could be seen on a second display in the control room by the experiment leader, who played the correct sounds at those times. The low-personal-relevance narrative contained only descriptive texts during which the narrator told what happened during the events. No personal words like “I”, “you”, or emotional words were used. An example of what she said: *“The dike is prolapsing. The road has disappeared, and cannot be used anymore. The area behind the dike is completely flooded with water. Go and see what kind of effect this had on the houses at the starting point and what had possibly been in those houses.”* The high-personal-relevance narrative contained mostly emotional texts. The narrator told that she was your roommate and how you live together with two others in the lowest house on the dike. She described how the participant knew the neighbours and animals around the house, and how the locations the participant visited were familiar. An example of

what she said: *"Oh no! The dike is completely prolapsed. The cycling-road has been completely wiped away, how can we still get to the train station? Let's quickly go back home. It looks like the entire area behind the dike has been flooded. I hope that our belongings and our cat, Flip, are still safe, he was locked inside the kitchen. Quickly go back home to have a look."*

2.3 Apparatus

The experiment was set up in the Recording Studio in the IPO building on the campus of Eindhoven University of Technology. The room was sound-proof and was connected to the control-room next to it. It did not have windows. For the experiment we used a 15.6" Asus K53U laptop with Windows 7. All participants filled out the questionnaires on this laptop. Half of the participants also watched a slideshow on this laptop, however, the other half played the videogame simulation on a large back-beamed 72 inch screen. The participant sat 250 cm away from this screen. We set up an audio system to support the videogame with realistic sound. The sound which was played was a recording of real rain and realistically loud (speakers were in the room behind the large screen). When the dike breached, a recording of a real waterfall was played. It was direction-sensitive, so when the participant turned around in the virtual environment, the sound seemed to come from a different direction, corresponding to its location in the virtual environment. The participants in the low immersive condition constantly had the room's lights on, while the participants in the high immersive condition had the lights off (light from the back-beamed screen lit the room). See Figure 2.2 for a photo of the setup.

We used Macromedia Authorware 7.0 to present the questionnaires to the participants, as well as the MouselabWeb application. We used Leevee Patroller 2007 for the simulation. We played the slideshow with Microsoft Media Player.

Figure 2.2 Left, the setup with lights on, for participants in the non-immersive conditions, right, the setup with lights off, for participants in the immersive conditions

2.4 Procedure

When participants entered (either a light or a dark room, depending on the experimental condition), they were briefly informed about the experiment. They were then asked to read and sign an informed consent form. The experiment leader then left and went to the control-room. First the participants were asked to fill out a demographics questionnaire with questions about age, education-level, floor they lived on, and whether or not they ever experienced a flood, and so on. They were then asked to fill out a Trait Presence questionnaire, about how quickly they feel present in specific situations. Next the participants were asked to imagine what it was like to either do groceries (low personal relevance condition), or experience a flood (high personal relevance condition).

Then, participants in the low immersive condition viewed a slideshow with a neutral (low personal relevance), or a personal (high personal relevance) narrative. The participants in the high immersive condition were asked to sit down in front of the large screen and start up the Levee Patroller simulation. They could control it with a wireless mouse and keyboard which were lying in front of them. The experiment leader in the control room played the neutral (low personal relevance) or personal (high personal relevance) narrative when the participant reached certain checkpoints in the videogame. When the participant finished the game, the narrator asked them to return to the laptop and continue with the questionnaires.

The IPQ Sense of Presence questionnaire and the Personal Involvement Inventory were presented directly after the simulation had ended. Authorware then redirected to the

MouselabWeb application on the internet, where the coping-actions questionnaire was presented. First participants were asked to 'search for coping actions', by hovering over closed boxes with questions written on them. On mouse-over, these boxes opened to reveal the answers. Finally, questions about participant's emotions regarding floods, and behavioral intentions for possible coping actions they would undertake were asked.

Finally, the participant was thanked, debriefed and paid an incentive of 5 (or 7) euros. See Figure 2.2 a graphical representation of the procedure.

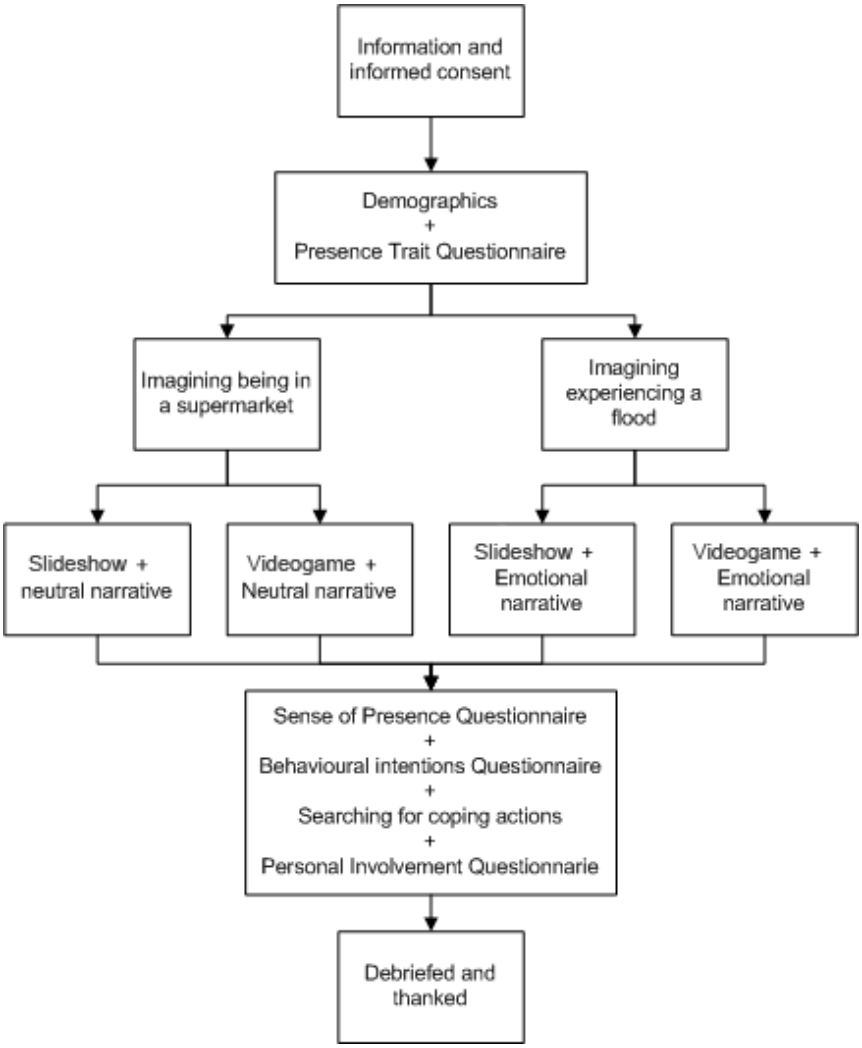

Figure 2.1 Experimental procedure in visual form

2.5 Measurements

We recorded participants' demographics at the beginning of the experiment (age, gender, level of education, flood-experience, floor they live on, etc.). A trait presence

questionnaire was also presented which was used to assess how well people were able to feel present in any given situation (Cronbach's $\alpha = 0.785$). This was used to control for differences between the experimental groups (this was not significantly different between groups).

After the participants finished the imagination task they were asked to write down what they imagined. This was to check whether or not they really imagined what they were asked to imagine.

After participants either watched the slideshow or played the videogame, the IPQ Sense of Presence questionnaire (Schubert et al., 2001) was presented to them. This is a five-point Likert scale with items like: *"I had the feeling I was surrounded by the virtual world."* and *"The virtual world seemed more real than the real world."* The 23-item questionnaire focused on Presence (10 items, Cronbach's $\alpha = 0.933$), Realism (6 items, Cronbach's $\alpha = 0.842$) and Involvement in the virtual environment (4 items, Cronbach's $\alpha = 0.759$). These three items were confirmed using a Factor Analysis with 3 fixed factors and a Varimax transformation. Not all of the 23 items were included by the Factor Analysis because they did not load significantly on one of the three items.

To check the level of personal relevance participants felt, we used the Personal Involvement Inventory (Zaichowsky, 1994) (Cronbach's $\alpha = 0.935$). This was a 10 item scale where participants indicated that they felt either more like one word than the other (important vs. unimportant, fascinating vs. mundane). Factor Analysis showed that only one factor could be extracted. However, the involvement questionnaire significantly correlated with all three factors from the IPQ Sense of Presence Questionnaire. Where the Involvement questionnaire correlates with the Presence factor ($r = 0.818$, $N = 103$, $p < 0.000$, two tails), with the Realism factor ($r = 0.719$, $N = 103$, $p < 0.000$, two tails), and with the Involvement factor ($r = 0.572$, $N = 103$, $p < 0.000$, two tails). This indicates that the Involvement questionnaire might have measured the same thing as the Presence questionnaire, or that presence and involvement are closely related to each other. Nevertheless, because we intended to use the Involvement questionnaire to measure Involvement, we still used it in the analysis.

We checked behavioral intentions by asking people to search for solutions against flooding. This was done using the MouselabWeb application (Willemsen & Johnsson, 2013) where participants saw a closed box with a question, for example "Is my residence safe after I

evacuated?" When the participant moved the cursor over the box, the answer to that question was shown: "The police and army will intensively guard the flooded area." The time which the participant hovered over the answers was recorded. The summed time of all boxes was taken as a measure how thoroughly participants searched for coping information.
After the participants searched for coping actions, their behavioral intentions to evacuate and their feelings were asked in a questionnaire. Examples are: *"How large do you estimate the chance that you would evacuate family members in case of a potential flood?"*, and *"Do you expect to be afraid that your property will damage because of a flood?"* According to Zaalberg and Midden (2012) this questionnaire delivered two components after an exploratory principal component analysis with "Negative Emotions" (two items) as one component, and "Evacuation" with three items. However, with the current data, we found: "Negative Emotions" with 10 items (Cronbach's alpha: 0.902), and "Evacuation and Property Damage" with 6 items (Cronbach's alpha: 0.662), with questions about expected property damage and evacuation intentions.

As in Zaalberg and Midden (2012), the following item was addressed separately: *"Would you purchase a flood insurance policy for 25 Euros a year if possible?"*
The item *"How much effect would it have if the government would nationally increase municipality taxes where rivers can be deepened and broadened?"* was also treated separately.

Summarizing, we used five measures for behavior, the dependent variables:

1. **Searching Time.** Searching assignment in MouselabWeb where participants had to search for information about floods. The total time they took searching for this information is called "Searching Time".
2. **Negative Emotions.** The response actions questionnaire's component: "Negative Emotions", with answers to questions about having negative emotions about floods or not (feeling scared or concerned).
3. **Evacuation and Property Damage.** The response actions questionnaire's component: "Evacuation and property damage", with answers to questions about the amount participants estimate a high damage to their property, and the chance they would evacuate themselves, loved ones and pets.
4. **Insurance Question.** The separately treated question*: "Would purchase a flood insurance policy for 25 Euros a year if possible?"*

5. **Taxes Question.** The separately treated question: *"How much effect would it have if the government would nationally increase municipality taxes where rivers can be deepened and broadened?"*

3. Results

3.1 Manipulation Checks

We manipulated immersion (as in Zaalberg & Midden, 2012), and personal relevance. Immersion was manipulated by using 1) a low immersive small screen on which a slideshow of a flood is played, and 2) a highly immersive interactive videogame featuring a flood on a large screen. Personal relevance was manipulated by 1) a lowly personal relevant neutral narrative played during the simulation of the flood, and 2) a highly personal relevant narrative played during the simulation of the flood. In the following paragraphs we investigated whether or not these manipulations were effective.

3.1.1 Immersion

Results suggested that our immersion manipulation was effective. That is, a planned comparison ANOVA showed that participants in the higher immersive condition felt a greater sense of presence than participants in the lower immersive condition; $t(99) = 5.70$, $p < .001$. See Table 3.1.

Table 3.1 Participants'presence scores in the high and low immersive conditions. A higher score indicates a higher presence.

	Mean	**Standard Deviation**
Low Immersion (Presence)	2.36	0.71
High Immersion (Presence)	3.24	0.84

3.1.2 Personal Relevance

Results suggested that our personal relevance manipulation was not effective. That is, a planned comparison ANOVA did not show that participants in the higher personal relevance condition felt any more or less involved than participants in the low personal relevance condition; $t(99) = 1.034$, $p = 0.30$. See Table 3.2.

Table 3.2 Participants' involvement scores in the high and low personal relevance conditions. A higher score indicates a higher involvement.

	Mean	Standard Deviation
Low Relevance (Involvement)	3.60	1.14
High Relevance (Involvement)	3.83	1.12

3.2 Testing hypotheses

To analyze the effects of our manipulations of immersion and personal relevance, we submitted the dependent variable scores to a 2 (immersion: high vs. low) x 2 (personal relevance: high vs. low) ANOVA. The following dependent variables were analyzed: Presence score (IPQ Sense of Presence questionnaire with the factors Presence, Realism and Involvement), Involvement score (Personal Involvement Inventory), Searching Time, Negative Emotions, Evacuation and Property Damage, Insurance Question, and the Taxes Question (explained in chapter 2).

In support of our hypothesis (Hypothesis 1), results showed that participants who had watched a slide show (low immersion condition) had a lower presence feeling score (M = 2.36, SD = 0.71) than participants who had played a videogame (high immersion condition; M = 3.24, SD = 0.84), $F(1, 99) = 32.46$, p = < .001. Participants in the higher immersive condition felt a greater sense of realism (M = 2.31, SD = 0.79) than in the lower immersive condition (M = 1.92, SD = 0.56); $F(1, 99) = 8.52$, p = .004 Participants in the higher immersive condition felt more involved (Presence factor) (M = 3.58, SD = 0.71) than participants in the lower immersive condition (M = 3.11, SD = 0.68); $F(1, 99) = 11.42$, p < .001. This finding was confirmed by a second measure: the Personal Involvement Inventory. Participants in the higher immersive condition felt more involved (as indexed by the Personal Involvement Inventory, with M = 4.11, SD = 1.13) than in the lower immersive condition (M = 3.33, SD = 0.99); $F(1, 99) = 13.73$, p < .001. See Figure 3.1.

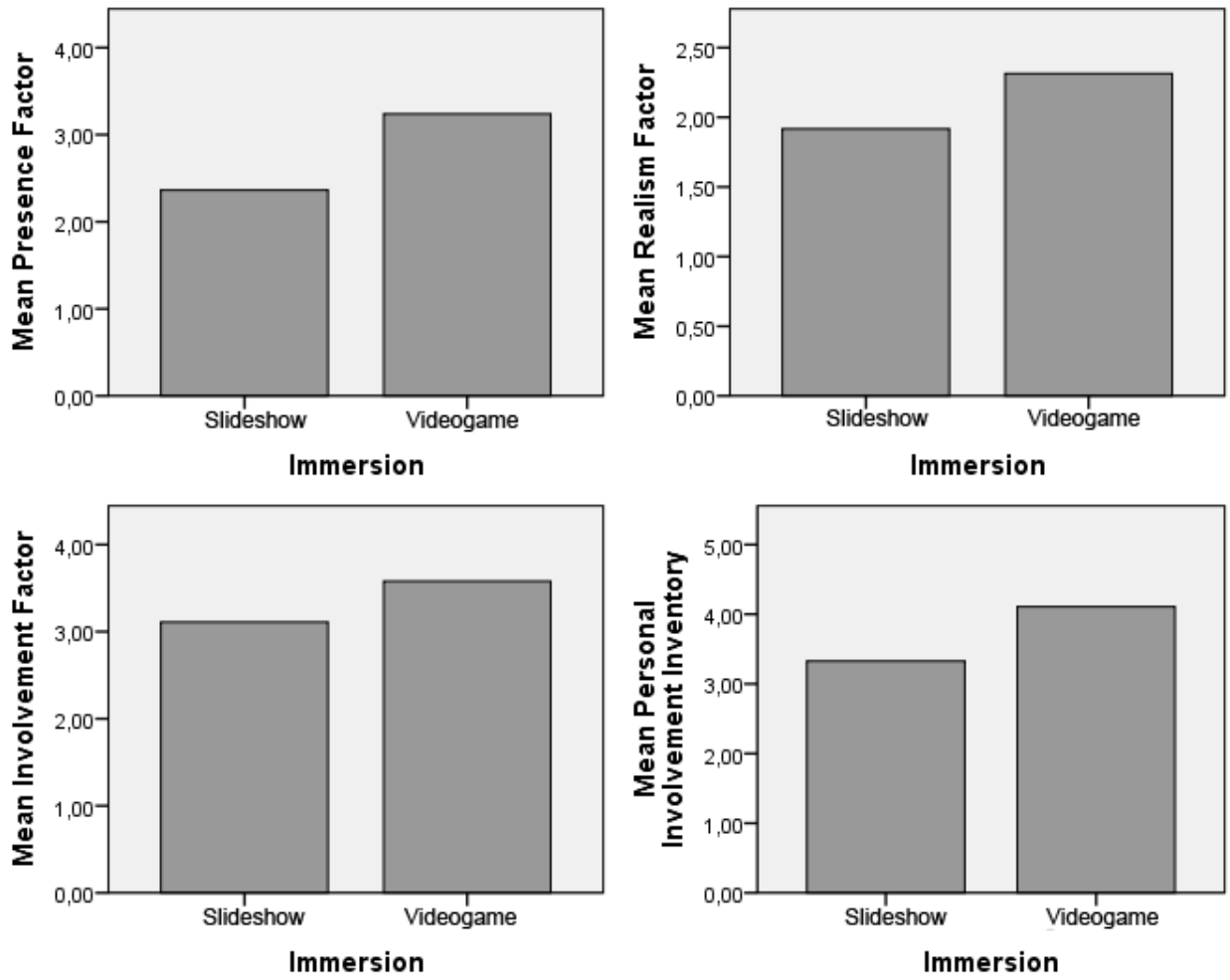

Figure 3.1 Participants' scores to the Presence, Realism, and Involvement factors, as well as the Personal Involvement Inventory.

These results partially corroborate hypothesis 1, which predicted that feelings of presence would be larger when the simulation was made more immersive. However, participants in the high immersive condition did not score higher than those in the low immersive condition on any of the 5 dependent variables related to coping actions. In other words, our findings do not support our second prediction of hypothesis 1. See Figure 3.2.

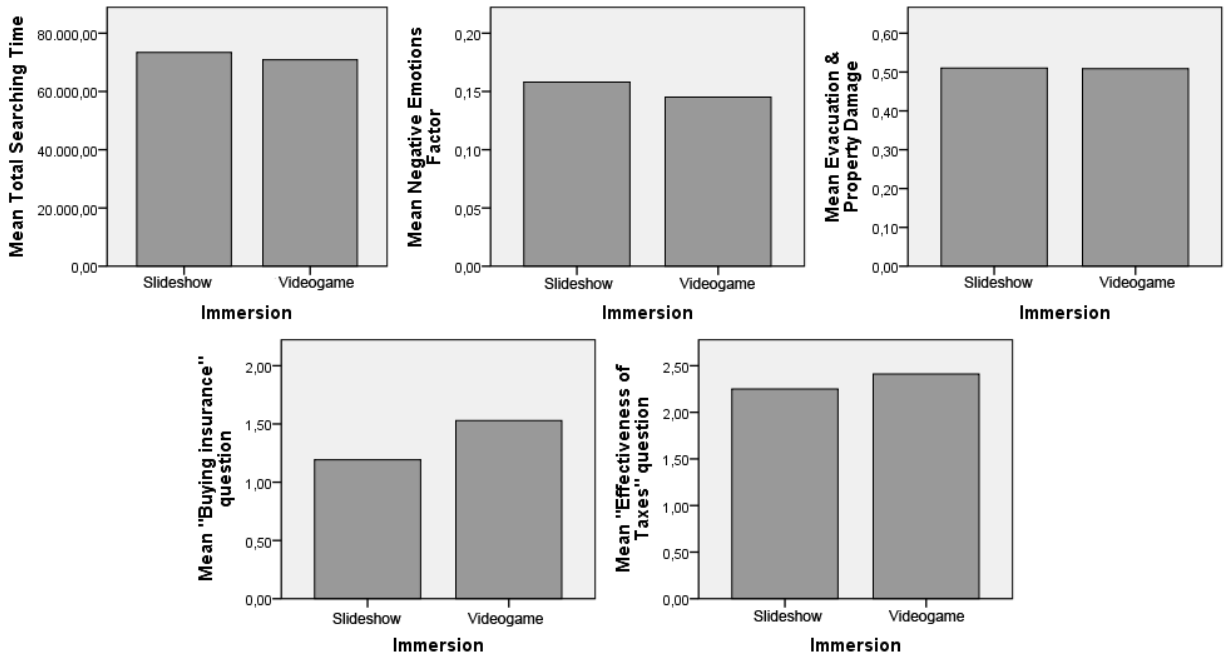

Figure 3.2 The difference between participants' scores in the low and high immersion conditions for Searching Time, the Negative Emotions factor, the Evacuation and Property damage factor, and the buying insurance and effectiveness of taxes questions.

Our ANOVA analysis did not show a main effect of personal relevance on presence and involvement (Hypothesis 2). Specifically, we did not find that the feeling of presence and active involvement increased with an increased personally relevant narrative. This suggests that our manipulation of Personal relevance was ineffective. See Figure 3.3.

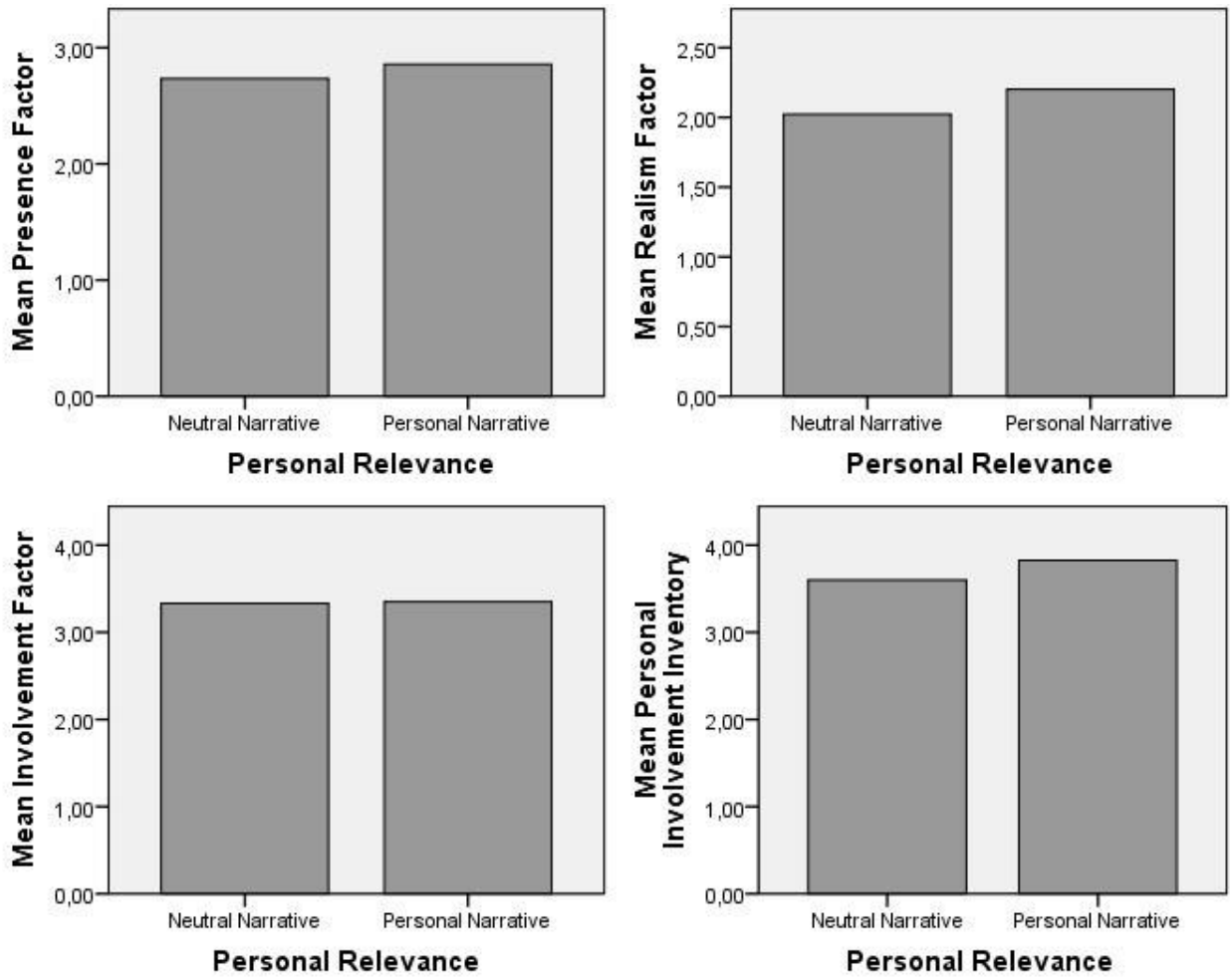

Figure 3.3 Graphical representation of the answers to the questions in the Presence, Realism, and Involvement factors, as well as the Personal Involvement Inventory.

In partial confirmation of hypothesis 2 , results showed that participants in the more involving conditions (personal narrative) scored the Taxes Question higher (M = 2.54, SD = 1.08) than participants in the less involving condition (neutral narrative) (M = 2.12, SD = 1.13); $F(1, 99) = 3.69$, $p = .056$. However, none of the 4 other dependent variables related to coping actions supported hypothesis 2. See figure 3.4.

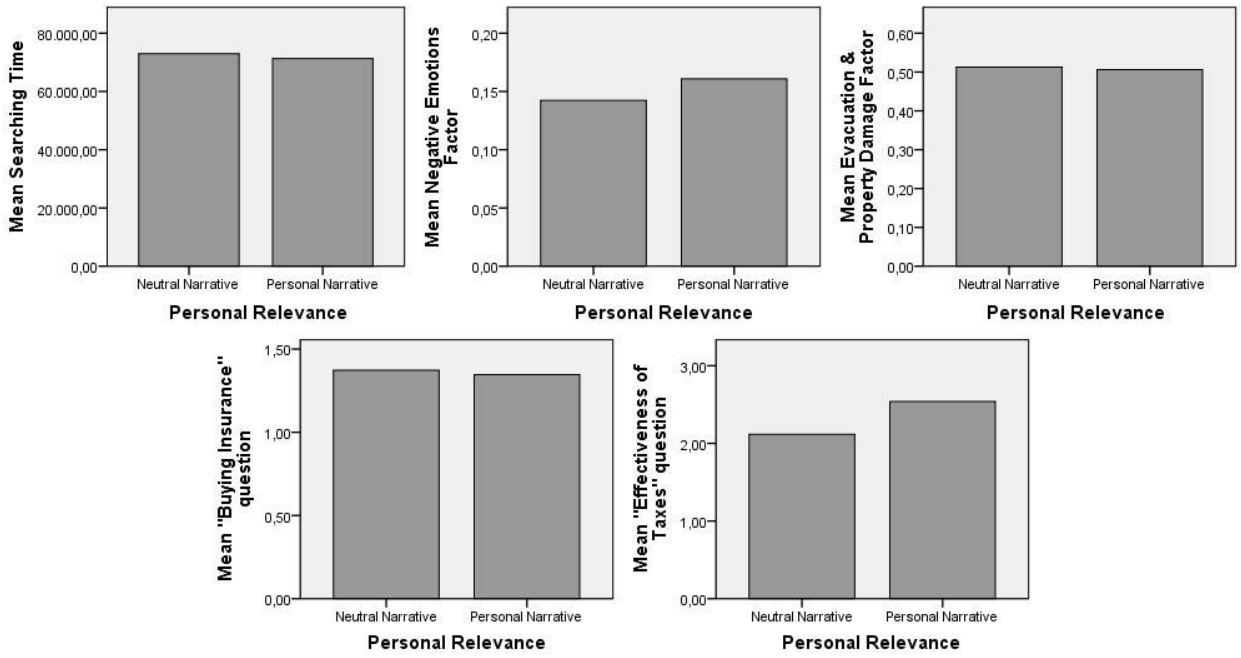

Figure 3.4 The difference between participants' scores in low and high personal relevance conditions for Searching Time, the Negative Emotions factor, the Evacuation and Property damage factor, and the buying insurance and effectiveness of taxes questions.

To test the combined effects of our manipulations of personal relevance and immersion (Hypothesis 3), we submitted participants' searching behavior (Searching Time) and feelings towards coping actions (Negative Emotions, Evacuation and Property Damage, Insurance Question and Taxes Question) scores to a 2 (immersion: high vs. low) x 2 (personal relevance: high vs. low) MANOVA. In weak partial support of hypothesis 3, we found a marginally significant interaction effect for one of the 5 dependent variables related to coping actions. Results showed that participants in the low immersive condition had a larger urge to evacuate and believed that more damage would occur because of a flood when the narrative they heard was personal (M = 0.52, SD = 0.07), than the participants who heard the neutral narrative (M = 0.50, SD = 0.09). These were the Evacuation and Property Damage scores. However, in contrast to hypothesis 3, in the higher immersive condition, participants who listened to the personal narrative had less urge to evacuate and believed that less damage would occur (M = 0.49, SD = 0.10) than the participants who heard a neutral narrative (M = 0.53, SD = 0.08); $F(1, 99) = 2.77$, $p = .099$. Further analysis of this effect showed no evidence for both simple effects. That is, the effect of personal relevance for participants in the high immersive conditions was not significant, F(1,100) = 2,07, p = .15, and the effect of personal relevance for participants in the low immersive conditions also was not significant, F

< 1. The results provided no evidence that the feeling of presence, involvement and the other 4 dependent variables related to coping actions were influenced by the multivariate effects of our manipulations. See Table 3.2 and Figure 3.3 for a clearer view of this effect.

Table 3.1 Participants' scores for the Evacuation and Property damage questionnaire (dependent variable 3, as discussed in chapter 2) with questions about how much damage the participants expected their property when a flood occurs, and whether or not they would evacuate themselves, their family and their pets. A higher score indicates a higher estimation of damage and a higher likelihood of evacuation.

"Evacuation & Property Damage" Factor	**Low immersion (slideshow)**		**High immersion (simulation)**	
	Mean score	Standard Deviation	Mean score	Standard Deviation
Low personal relevance (neutral narrative)	0.499	0.093	0.527	0.084
High personal relevance (personal narrative)	0.521	0.074	0.491	0.098

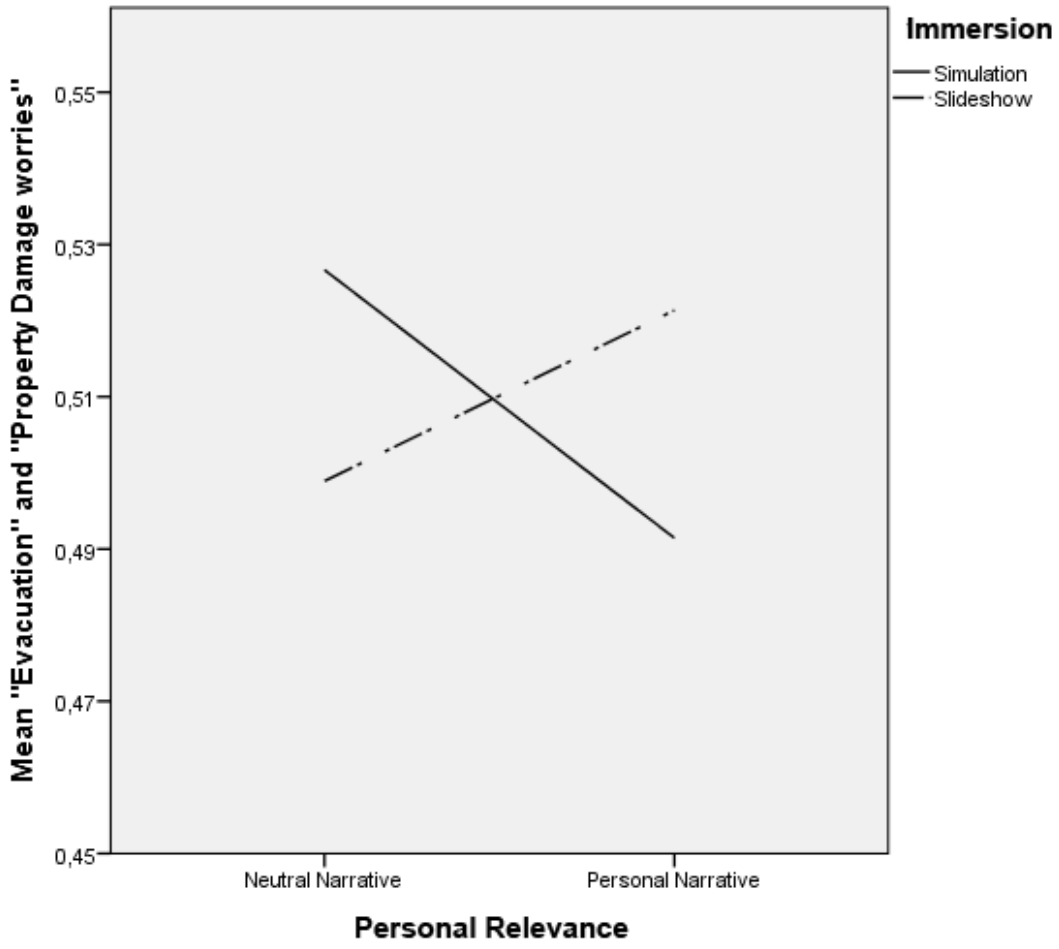

Figure 3.5Participants' scores for the Evacuation and Property damage questionnaire graphically represented.

3.5 Internal trait to feel present

Furthermore, according to literature, people have an innate trait for feeling present in a situation or not. This means that people who are more likely to feel present usually have a higher feeling of presence in situations, whereas people who are less likely to feel present usually have a lower feeling of presence in a situation. The Trait Presence questionnaire was used to measure this innate propensity for presence. It was a five-point scale where 1 and 2 stood for not or less likely to feel present, and 3, 4 and 5 stood for more or very likely to feel present. The mean of the answers to this questionnaire was calculated and participants were divided in two groups (middle split): low trait presence (N = 76 participants), and high trait presence (N = 27). This data-split led to some interesting new findings which will be discussed below.

Participants with a low innate trait to feel present scored the factor “Evacuation and Property Damage” marginally significantly higher (participants were more likely to evacuate and had a higher estimation of property damages) when they heard the personally relevant narrative than the neutral one, when they watched the slideshow. However, when playing the videogame, participants who heard the personally relevant narrative scored this factor lower than the participants who heard a neutral narrative; $F(1, 72) = 3.22$, $p = .077$. This is the same as we found when taking all participants together. However, for participants with a high innate trait to feel present, this effect is not present; $F(1, 23) = 0.00$, $p = .966$. Figure 3.6 shows the results for all participants together, as well as for a high and low innate trait to feel present. These results are different from when we analyzed all participants together, which reveals that this effect only occurs when participants lack an innate trait to feel ´present´ in a virtual environment.

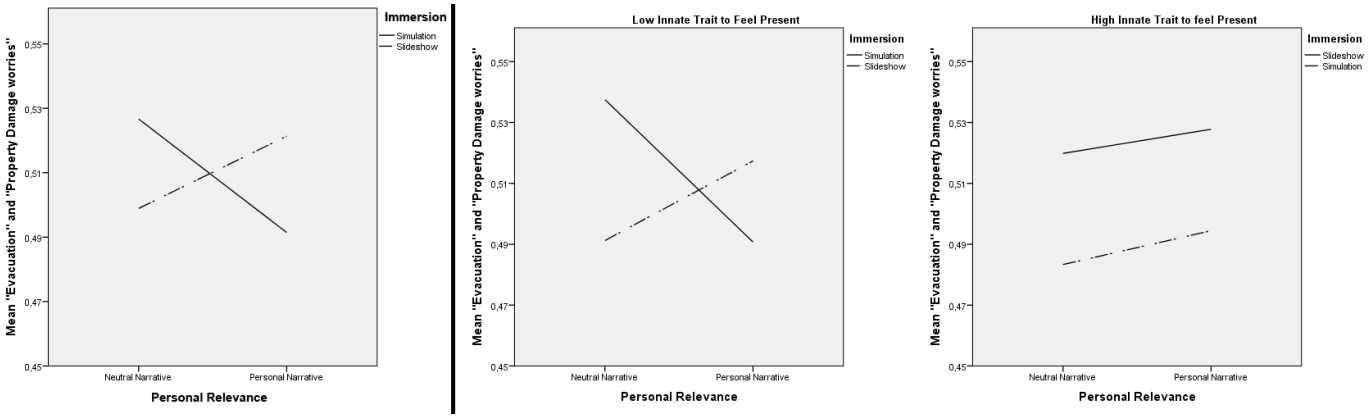

Figure 3.6 Participants’ scores for the Evacuation and Property damage for (left) all participants, and (right) for a low and high innate trait to feel present..

We found no difference in Searching Time between conditions. When split on the innate trait, again no difference was found for participants with a low innate trait to feel present. However, participants with a high innate trait to feel present who watched the slideshow (low immersion) searched marginally significantly longer for coping actions (M = 86529ms, SD = 32850ms) than participants who played the videogame (M = 66111ms, SD = 17377ms); $F(1, 99) = 3.24$, $p = .085$. In figure 3.7 this is shown.

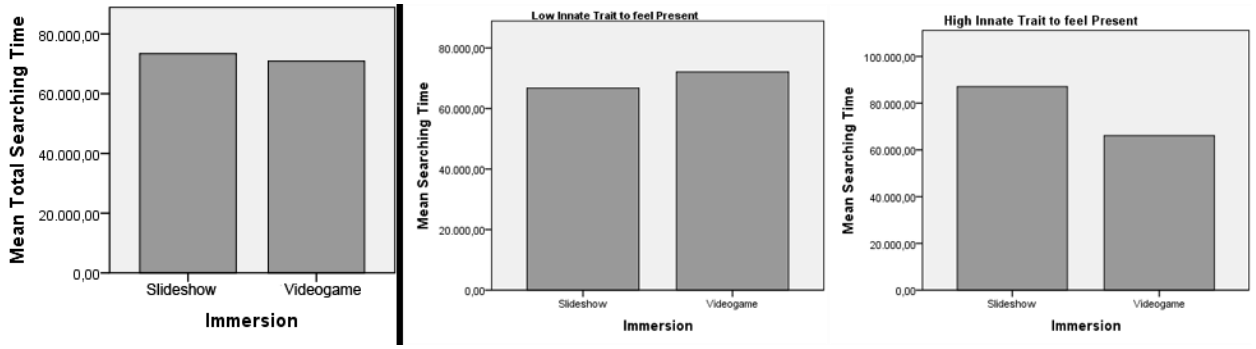

Figure 3.7 Participants' mean searching time for (left) all participants, and (right) for participants with low or high innate traits to feel present.

When all participants were taken together, we found a marginally significant difference for participants in either the low or the high personal relevance conditions for the Taxes Question scores where more personal relevance lead to a higher score. However, when we only looked at participants with a low internal trait to feel present, we found no difference to the answer on this question. When we only looked at participants with a high internal trait to feel present, this difference suddenly became a lot more significant. The participants who heard the neutral narrative judged increasing taxes as less effective (M = 1.90, SD = 1.05) than participants who heard a personal narrative (M = 2.75, SD = 0.84); $F(1, 23) = 4.85$, p = .038. See Figure 3.8.

Figure 3.8 Participants' scores for the Effectiveness of Taxes question. Left, all participants together, right, for low and high innate traits to feel present.

4. Discussion

This research investigates the determinants of effective user persuasion in virtual environments. We tried to answer the question: "*What are the influences of immersion (high vs. low) and personal relevance (high vs. low) in a virtual environment where a flood occurs, on people's sense of presence in the virtual environment and on future coping actions towards floods?*" Earlier research suggested that both immersion and personal relevance could have an influence on the feeling of presence and possible outcomes of the virtual simulation. However, these concepts were not yet jointly investigated. Therefore we conducted an experiment in which both immersion (slideshow vs. videogame) and personal relevance (neutral vs. personal narrative) were manipulated. The results indicated that immersion created a feeling of presence in the virtual environment. However, it did not have an influence on coping actions towards floods. Our personal relevance manipulation did not create a feeling of presence, but did positively influence coping actions towards floods. Both of these findings partially support hypotheses 1 and 2, which we presented in chapter 1. The combined effect of immersion and personal relevance showed that coping intentions were positively influenced by personal relevance in a less immersive virtual environment (as in hypothesis 3), but they were negatively influenced by personal relevance in a highly immersive virtual environment (contrary to hypothesis 3). This effect was only marginally significant, and therefore very weak.

As was previously demonstrated by Zaalberg & Midden (2012), virtual flood experiences can enhance people's willingness to adopt coping actions. The current study extended Zaalberg & Midden's study to investigate the effects of added personal relevance on coping actions. In contrast to their study, we found no evidence that supported an increase in searching behavior and willingness to adopt coping actions when participants felt more present in the simulation. Our findings corroborate findings reported by De Hoog, Stroebe & de Wit (2008) and Chittaro (2012). In their studies, as well as in Zaalberg & Midden's study, a virtual risk experience influenced behavior (or behavior intentions). In contrast to Zaalberg and Midden's (2012) expectations, we did not find a stronger adoption of coping actions when a high level of immersion was combined with a high level of personal relevance, but a weaker adoption of coping actions (however only marginally significant). This finding was also counter to Chittaro & Zangrando (2010), and Khaled et al. (2007). Although in agreement

with their study, a more personally relevant simulation did lead to more effective persuasion in a low immersive simulation. Our study does agree with Mikropoulos & Strouboulos (2004) and Witmer & Singer (1998) who identified sensory factors, distraction factors and realism factors as important indicators of presence, which is how we created our immersion conditions. Our highly immersive condition contained these factors, while our less immersive condition did not. Participants felt more present in the highly immersive conditions than in the less immersive ones. Because not all of our results corroborate previous findings be other authors, the present research opens new doors for future research on the discrepancies.

Conclusions

This research showed that it is possible to simulate a real risky experience in virtual reality to bring about future coping intentions. When a virtual experience was accompanied by a personal narrative, the current research suggested that it is better to use a less immersive medium to influence future coping intentions, whereas a neutral story works better combined with an interactive virtual experience. A more immersive simulation led to a more intense feeling of presence, but not to an increase in future coping actions or searching behavior. More personal relevance only slightly increased future coping actions. This study provided information on how to make a simulation to warn people against floods, and motivate them to protect their homes.

Limitations

To measure whether the manipulation of personal relevance was effective, the participants filled out the "Personal Involvement Inventory". However, we found no evidence for a difference in mean scores to this questionnaire for low or high personal involvement groups. The answers do correlate significantly with the answers participants gave to the IPQ Sense of Presence Questionnaire. This could mean that we either did not choose the correct questionnaire to measure personal involvement, or that our manipulation was ineffective. If the latter is the case, it is surprising that we still found some marginally significant results between these conditions. Therefore, next time, a larger-scale pre-test to check for the manipulation's effectiveness should be done.

Since the current study was an extension of Zaalberg and Midden's (2012) study, we expected that, we would find the same results for searching (in MouselabWeb) and coping

actions by participants when the feeling of presence was induced. However, our own results did not show any difference between participants in low and high immersion conditions for searching behavior. I suspect that this is because the current study had participants from a homogeneous age-group, while Zaalberg and Midden's group had a large range of ages among their participants.

All participants in both Zaalberg and Midden's study and our own were from the vicinity of Eindhoven. However, our participants mentioned that because Eindhoven is a safe place above sea-level— they were less worried about floods and therefore were not motivated to prepare for floods themselves. This could explain why participants would not be motivated to adopt coping actions. Therefore, if this study would be repeated in a lower laying area in the Netherlands which is under direct threat of flooding, different results could be expected. A future suggestion would be to use participants who currently live in such an area. However, when even people who believe that they live in a ´safe´ area are motivated to adopt coping actions, we can be sure that using virtual reality to give them an emotional experience of a flood truly works.

Participants complained about the length of the coping actions and emotions questionnaire, and not all questions could be included in the analysis. This was not mentioned by Snoep (2008) or Zaalberg & Midden (2012) so we did not change it. If this study were to be repeated, we would suggest changing this questionnaire to create shorter questions, which can all be fitted on the two factors we extracted from the questionnaire.

As we suspected in hypothesis 3, we found a mediation effect of immersion and personal relevance on coping actions, however only marginally significant. In line with our hypothesis, participants who watched the slideshow (low immersion) expected more property damage and were more likely to evacuate when they heard a personal narrative than when they heard a neutral narrative. We expected that in the high immersive condition, we would find a great positive effect of personal relevance on presence, involvement and the adoption of coping actions. However, our results indicate that participants who played the videogame (high immersion) expected *less* property damage and were *less* likely to evacuate when they heard a personal narrative than when they heard a neutral narrative. This is the reverse of the less immersive conditions. A reason that this effect was reversed from what we expected

could be that the videogame was already so realistic and immersive that a story told by a narrator does not further enhance immersion, but might distract from the events happening in the virtual environment (this was mentioned by one of the participants). A neutral narrative could be less distracting than a personal one, which would explain the reversed effect. Another possibility could be that the fit of the personal narrative was not in line with the quality of the simulation, and was therefore distracting. The narrative was not read by a professional actor, and might not have sounded dramatic enough, or was not worded dramatically enough (fitting the dramatic images of the simulation). For the same reason, the tone of voice might not have been interpreted by participants as the intended emotions (one of the participants mentioned that the tone of the narration seemed happy rather than dramatic). A discrepant narrative could have caused participants to lose the feeling of presence, or mentally pulled them out of the immersion of the experience. In this case, future advice would be to hire a voice actor to make sure that the narrative is received as intended. The next question would be whether or not a multimodal simulation (visuals and narratives) are distracting factors rather than improving the feeling of presence? Maybe a multimodal simulation can be extremely effective if all elements fit well to each other and are all of high quality, which could be a challenge in itself to create. Participants who watched the slideshow needed more imagination to feel immersed in the situation, which could explain why a personal narrative was more effective than a neutral one in the low immersive conditions.

To investigate the adoption of coping actions, we presented 5 different dependent variables. However, whenever we found an effect of our manipulations on coping actions, only one or a few of the dependent variables were affected. This could mean that persuasion through an immersive and personally relevant simulation could work, but that these factorsdo not have a strong effect, or only a partial effect on persuasion. For now, it does not seem that a virtual environment can completely substitute a real risk experience to achieve the same emotional responses. Notwithstanding, this is still a field in research where more studies with improved personal relevance and immersion functions seem necessary.

After extra exploration of the data, we found that participants with a high innate ability to feel present in situations searched longer for possible coping actions, and had more intentions to protect themselves against floods in the future when they were in the higher immersion and higher personal relevance conditions than in the lower ones. This could mean

that a virtual reality used to warn people about risks is effective only on a small group of people, while the people who do not have a high innate ability to feel present are not persuaded as strongly.

Suggestions for future research

This study adds to the scientific fields of persuasion, and human computer interactions. It shows that immersion can create a feeling of presence, but that this does not necessarily mean that coping actions will follow. The link between presence and personal relevance is also not as simple as initially thought, which opens doors for future research on virtual simulations, personal relevance and presence. To validate the findings in this research, I would suggest either repeating this research with several improvements, or manipulating the same dimensions, using a different topic (a different risk experience). To improve upon this research I would suggest creating a more extreme level of personal relevance by adding real people to the virtual environment. For example one could display the narrator of the story in the virtual environment and overlaying a photo of one of the participant's real friends on the character. It would also be ideal if the simulation could take place in the participant's own street with realistically high water levels; however, this level of realism remains practically infeasible. Another possibility is to let the participant's friend narrate the story, and if this is not done, to hire a professional actor. Finally, it would be advisable to measure the level of personal involvement in a different way. Instead of using the Personal Involvement Inventory, create a new questionnaire with more situation specific questions and validate it in a pre-test. Questions could be: "How personal did the flooding experience in the virtual environment feel to you?", or "How much did you empathize with the people who suffered from the flood in the virtual environment?" This research suggests that it is not necessary to use high-resolution 3D games to achieve an increased adoption of coping actions after viewing them. Simulation researchers can therefore focus new experiments on personal relevance in combination with lower resolution images, or investigate further the link between the realism of the simulation combined with different degrees of personal relevance. In this way, the ideal balance can be found to motivate citizens to protect their homes from imminent risks.

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6. Appendix

6.1 Demographics questionnaire

Dutch	**English**
Wat is uw leeftijd? ……	What is your age? ……
Bent u man of vrouw? • Man • Vrouw	Are you man or woman? • Man • Woman
Wat is de hoogste opleiding die u heeft voltooid? • Lager onderwijs/basisschool • Lager beroepsonderwijs of Mavo (LTS, LEAO, VMBO, Huishoudschool, MULO, ed.) • Middelbaar beroepsonderwijs of HAVO (MTS, MEAO, ed.) • VWO (Atheneum, Gymnasium, HBS, Lyceum) • Hoger beroepsonderwijs of Wetenschappelijk onderwijs (HTS, HEAO, bachelor, master, doctoraal, doctoraat)	What is the highest education that you finished? • Lower education/primary school • Lower secondary education (VMBO) • Medium secondary education (HAVO) • Higher secondary education (VWO) • College or university (bachelor, master, doctoral)
Hoe veel computerervaring heeft u? • Geen (u werkt zelden of nooit met computers) • Basis (u kunt e-mailen en internetten) • Gemiddeld (u werkt geregeld met programma´s als Word, Excel, ed.) • Expert (u kunt eventuele computerproblemen zelf oplossen)	How much computer experience do you have? • None (You rarely or never work with computers) • Basic (You can send e-mails and use internet) • Medium (You often work with programs like Word, Excel, etc.) • Expert (You can potentially solve your own computer problems)
Hoe veel ervaring heeft u met computerspellen? • Geen (u speelt nooit computer spellen) • Basis (u speelt simpele computerspellen zoals Solitaire, Freecell en Hearts. Etc.) • Gemiddeld (u speelt weleens online spellen (MMORPGs, strategy games), First person shooters, race-spellen, etc.) • Expert (u speelt vaak online spellen (MMORPGs, strategy games), First person shooters, race-spellen, etc.)	How much experience do you have with computer games? • None (you never play computer games) • Basic (you play simple computer games like Solitaire, Freecell, and Hearts, etc.) • Medium (you sometimes play online games (MMORPGs, strategy games), First person shooters, racing games, etc.) • Expert (you often play online games (MMORPGs, strategy games), First person shooters, racing games, etc.)

Wat is de 4-cijferige postcode van uw woonadres?	What are the 4 digits of your home address' postal code? .....
Op welke verdieping bevindt zich de voordeur van uw <u>eigen woning</u> (dus niet een eventuele gemeenschappelijke ingang)? • Begane grond • Eerste verdieping • Tweede verdieping • Hoger dan tweede verdieping	On what flood is the front door of your own home (so not a common entrance)? • Ground floor • First floor • Second floor • Highter than the second floor
Heeft u in het verleden te maken gehad met overstroming (onder water staan) van uw bezittingen (bv. woning/tuin/erf)? • Ja • nee	Did you have a past experience with flooding (inundation) of your property (e.g. home/garden/land)? • Yes • no
Bent u als gevolg van dreigend hoogwater of overstroming wel eens vrijwillig of gedwongen geëvacueerd? Opgelet, weigering geldt ook als evacuatie! • Ja • Nee	Have you ever been voluntarily or forcefully evacuated from your home as a consequence of threateningly high water or a flood? Refusal also counts as evacuation! • Yes • No

6.2 Trait Presence questionnaire

All answers are given on the following scale:

1. nooit / never
2. een enkele keer / on occasion
3. redelijk vaak / reasonably often
4. vaak / often
5. heel erg vaak / very often

Dutch	**English**
Raakt u wel eens zo betrokken bij een televisieprogramma of boek dat andere mensen moeite hebben om uw aandacht te krijgen?	Do you sometimes feel so intensely involved with a television program or book that other people have difficulty to get your attention?

Raakt u wel eens zo betrokken bij een film dat u zich niet meer bewust bent van de dingen die om u heen gebeuren?	Do you sometimes feel so involved with a movy that you are no longer aware of the things happening around you?
Hoe vaak identificeert u zich in sterke mate met de personages in een verhaal?	How often do you identify yourself strongly with characters in a story?
Gaat u wel eens zo op in een dagdroom dat u zich niet meer bewust bent van de dingen die om u heen gebeuren?	Do you sometimes lose yourself in a daydream that you are no longer aware of the things happening around you?
Heeft u wel eens dromen die zo realistisch zijn dat u verward wakker wordt?	Do you sometimes have dreams that are so realistic you wake up confused?
Bent u wel eens geschrokken van iets dat op televisie of film werd getoond?	Did you ever get frightened from something that was shown on television or in a movie?
Bent u wel eens bang of angstig gebleven lang nadat u een enge film gezien had?	Did you ever stay scared or frightened long after you've seen a scary movie?
Raakt u snel en intens betrokken bij films of televisiedrama?	Do you feel intensely involved with movies or television dramas quickly?
In hoeverre bent u op dit moment alert?	How alert are you at this moment?
In hoeverre voelt u zich vandaag lichamelijk uitgerust?	How physically rested do you feel today?
Hoe goed bent u in het negeren van afleidingen uit de omgeving wanneer u ergens intensief mee bezig bent?	How well are you with ignoring distractions from your surroundings when you are working on something intensively?
Raakt u tijdens het sporten wel eens het besef van tijd kwijt?	Do you lose track of time during sports?
Bent u wel eens opgewonden geraakt van een achtervolging of vechtscene op televisie of film?	Did you ever get excited from a chase or fighting scene on television or in a movie?
Bent u wel eens zo intensief met iets bezig dat u het besef van tijd kwijtraakt?	Do you sometimes work on something so intensively that you lose track of time?
Raakt u wel eens zo betrokken bij een videospel dat het net lijkt alsof u in het spel zit in plaats van dat u een joystick bedient en	Do you sometimes feel so involved in a videogame that it seems like you are inside the game, instead of controlling a joystick

naar het scherm kijkt?	and watching a screen?
Hoe vaak speelt u videospelletjes?	How often do you you play videogames?

6.3 Imagination Task

Neutral Assignment Dutch	**Neutral Assignment English**
U gaat nu een inlevingsopdracht doen. Wilt u 2 minuten na gaan denken over hoe het is om boodschappen te doen? Denk na over naar welke supermarkt u gaat, hoe deze eruit ziet van binnen, hoe druk is het, en wat voor producten u mee neemt. Probeer u in te leven in hoe het ruikt, klinkt en voelt om in de supermarkt te lopen, enzovoort. Na het nadenken over deze denkbeeldige ervaring wordt u gevraagd om op te schrijven wat u mee heeft gemaakt. Als u op "verder" drukt zal het scherm wit worden. Als de twee minuten voorbij zijn zal automatisch de volgende vraag verschijnen.	You are now going to do an imagination assignment. Please think for 2 minutes what it is like to do groceries? Think about to which supermarket you are going, what it looks like from the inside, how busy it is, and what kind of products you will bring with you. Try to imagine what it smells like, sounds like and feels like to walk through a supermarket, etcetera. After the thinking about this imaginary experience, you will be asked to write down what you experienced. If you click on “continue” the screen will become white. When the two minutes are over, the next question will automatically appear.
Leef u nu in.	Imagine now.
Vul in het onderstaande vak in wat u heeft meegemaakt in de denkbeeldige situatie. Beschrijf alles zorgvuldig. Let op!! Druk niet op "enter" tot u klaar bent. Als u op "enter" duwt gaat u naar het	Fill in, in the square below, what you experienced in the imaginary situation. Describe everything carefully. Attention! Don’t press “Enter” until you are finished. When you press “enter” you will go

volgende scherm.	to the next screen.

Personal Assignment Dutch	**Personal Assignment English**
U gaat nu een inlevingsopdracht doen. Wilt u 2 minuten na gaan denken over hoe het is om een overstroming mee te maken? Denk na over het dat water uw eigen straat binnen stroomt, hoe het mensen, dieren, en dingen meesleurt, wat voor beschadigingen uw woning op loopt, en of er mensen (en uzelf) gewond raken of verdrinken. Probeer u in te leven over hoe het ruikt, klinkt en voelt om deze overstroming mee te maken. Na het nadenken over deze denkbeeldige ervaring vragen we u om opschrijven wat u mee heeft gemaakt. Als u op "verder" drukt zal het scherm wit worden. Als de twee minuten voorbij zijn zal automatisch de volgende vraag verschijnen.	You are now going to do an imagination assignment. Please think for 2 minutes what it is like to experience a flood? Think about how water enters your own street, how people, animals and items are dragged along, what kind of damages your residence will have, and of people (and yourself) get injured or drown. Try to imagine what it smells like, sounds like and feels like to experience this flood. After the thinking about this imaginary experience, you will be asked to write down what you experienced. If you click on “continue” the screen will become white. When the two minutes are over, the next question will automatically appear.
Leef u nu in.	Imagine now.
Vul in het onderstaande vak in wat u heeft meegemaakt in de denkbeeldige situatie. Beschrijf alles zorgvuldig. Let op!! Druk niet op "enter" tot u klaar bent. Als u op "enter" duwt gaat u naar het volgende scherm.	Fill in, in the square below, what you experienced in the imaginary situation. Describe everything carefully. Attention! Don’t press “Enter” until you are finished. When you press “enter” you will go to the next screen.

6.4 IPQ Sense of Presence questionnaire

All answers are given on the following scale:

1. Sterk mee oneens / strongly disagree
2. Mee oneens / disagree
3. Niet mee oneens/niet mee eens / not disagree/not agree
4. Mee eens / agree
5. Sterk mee eens / strongly agree

Dutch	**English**
"Ik had het gevoel omgeven te zijn door de virtuele wereld."	“I had the feeling to be surrounded by the virtual world.”
"Ik had het gevoel slechts plaatjes te bekijken."	“I had the feeling I was just watching images.”
"Ik had niet het gevoel in de virtuele ruimte aanwezig te zijn."	“I did not have the feeling to be in the virtual environment.”
"Ik had meer het gevoel actief bezig te zijn in de virtuele ruimte, dan dat ik het gevoel had passief naar de virtuele ruimte te kijken."	“I had the feeling to be actively present in the virtual environment, rather than having the feeling to be passively watching the virtual environment.”
"Ik voelde me aanwezig in de virtuele ruimte."	“I felt present in the virtual environment.”
"Ik had het gevoel dat ik op dezelfde plek was als de objecten (bv. trap, huizen) in de virtuele wereld. "	“I had the feeling that I was in the same place as the objects (e.g. stairs, houses) in the virtual environment.”
"De virtuele wereld kwam echt op mij over.”	“The virtual world seemed real to me.”
"De virtuele wereld kwam echter (realistischer/natuurlijker) op mij over dan de werkelijke wereld."	“The virtual world seemed more real (realistic/natural) to me than the real world.”
"Mijn visuele beleving in de virtuele omgeving kwam overeen met mijn visuele beleving van de echte wereld."	“My visual experience in the virtual environment was similar to my visual experience in the real world.”
"De virtuele wereld kwam werkelijk op mij over (niet te onderscheiden van de echte wereld)."	“The virtual world seemed real to me (not distinguishable from the real world).”
"De gesimuleerde overstroming kwam geloofwaardig op mij over."	“The simulated flood seemed realistic to me.”
"De gesimuleerde overstroming kan ook in werkelijkheid plaatsvinden."	“The simulated flood can happen in real life.”
"Ik had sterk het gevoel dat objecten (bv. trap, huizen) in de virtuele wereld driedimensionaal waren)."	“I strongly had the feeling that objects (e.g. stairs, houses) in the virtual world were three-dimensional.”
"Ik was me niet bewust van mijn echte omgeving."	“I was not aware of my real environment.”

"Ik lette nog op de echte omgeving."	“I was still paying attention to my real environment.”
"Ik ging volledig op in de virtuele wereld."	“I was completely engulfed in the virtual world.”
"Ik was me erg bewust van de echte omgeving (bv. geluiden van buiten, andere mensen, etc.) terwijl de virtuele wereld aan mij voorbij trok."	“I was very conscious of the real environment (e.g. sounds from outside, other people, etc.) while I was watching the virtual world.”
"Ik verloor het besef van tijd."	“I lost track of time.”
"De computer gecreëerde wereld gaf mij de indruk daar te zijn."	“The computer generated world gave me the impression that I was there.”
"Ik was onder de indruk van de kwaliteit van de driedimensionale wereld (bv. de trap, de huizen)."	“I was impressed by the quality of the three dimensional world (e.g. stairs, houses).”
"Ik was onder de indruk van de kwaliteit van de dynamische weergave van diverse simulaties (bv. golvend wateroppervlak, snelstromend water)."	“I was impressed by the quality of the dynamic visual aspects of the various simulations (e.g. waves, surface of the water, quickly moving water).”
"Ik maakte onderdeel uit van de verhaallijn in de denkbeeldige wereld."	“I was part of the storyline in the imaginary world.”
"Ik was verrast door de diverse simulaties in de denkbeeldige wereld."	“I was surprised by the various simulations in the imaginary world.”

6.5 Personal Involvement Inventory

On a 7-point scale.

The virtual experience was:

Belangrijk								Onbelangrijk*
Saai								Interessant
Relevant								Irrelevant*
Opwindend								Niet opwindend*
Betekent niets voor mij								Betekent veel voor mij
Aantrekkelijk								Onaantrekkelijk*
Fascinerend								Alledaags*
Waardeloos								Waardevol
Voel me betrokken								Voel me niet betrokken*
Onnodig								Nodig

A * means reverse coded.

English:

Important								Unimportant
Boring								Interesting
Relevant								Irrelevant
Exciting								Not exciting
Means nothing to me								Means a lot to me
Attractive								Unattractive
Fascinating								Mundane
Useless								Useful
I feel involved								I feel uninvolved
Not necessary								Necessary

6.6 Behavioral Intentions Questionnaire MouselabWeb

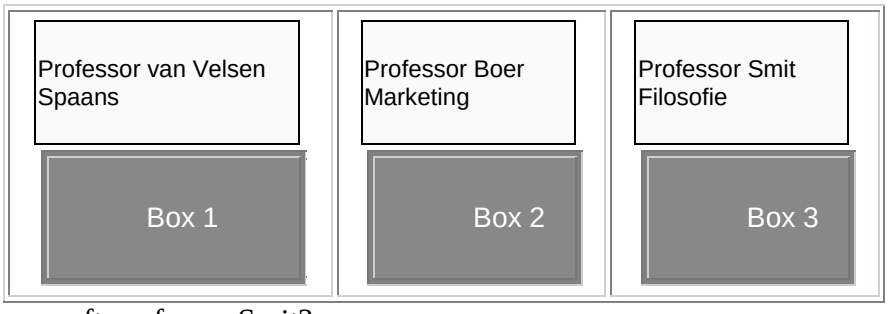
6.6.1 Dutch

Oefentaak voor het zoeken naar informatie

In deze oefentaak word je geleerd informatie te zoeken.

De informatie zit verscholen achter boxen. Je kunt informatie zoeken door met de cursor (het pijltje) over een box te bewegen. De box gaat dan open en je kunt de informatie bekijken, totdat je de cursor weer buiten de box beweegt.

Deze oefentaak is ontworpen om je te laten wennen aan het in en uit de box bewegen van de cursor om de informatie te bekijken. Achter iedere box is informatie verborgen over een college en de bijbehorende docent. Kijk naar de informatie achter de 3 boxen, beantwoord de bijbehorende vraag en ga daarna naar de volgende opdracht.



Welke College geeft professor Smit?

- Spaans

- Marketing
- Filosofie

Lees onderstaande tekst aandachtig door voordat u de opdracht uitvoert

Klimaatverandering kan in de toekomst hoge rivierwaterstanden veroorzaken. De zojuist getoonde overstromingssimulatie laat zien wat de gevolgen voor diepliggende polders kunnen zijn als rivierdijken doorbreken. Op het einde van de simulatie was de maximale waterstand bereikt. Het water stroomde even snel de diepliggende polder binnen als het elders de polder weer verliet.

Instructie

Stelt u zich de bij de rivierdijk gelegen woning voor, terwijl de rivierdijk op doorbreken staat door de hoge rivierwaterstanden. Beschermende maatregelen zijn bedoeld om schade aan bezittingen en gezondheid te voorkomen of the verminderen. Ga in onderstaand schema op zoek naar nadere informatie over diverse beschermende maatregelen.

Een rij in het schema biedt informatie over preventieve evacuatie uit het bedreigde gebied. De andere rij biedt informatie over diverse preventieve maatregelen om water buiten de deur te houden (bv. zandzakken en waterschotten).

Lees eerst alle vragen in het schema rustig door. Ga dan met de cursor (het pijltje) op die vragen staan waar u graag antwoord op wilt hebben. Antwoorden blijven zichtbaar zolang als u met de cursor op een vragenvlakje blijft staan.

Als u zichzelf voldoende heeft geinformeerd gaat u naar de volgende pagina waar u aangeeft welke specifieke maatregelen u het meest geschikt vindt voor de hiervoor beschreven woning waar de rivierdijk op doorbreken staat door hoge rivierwaterstanden.

Preventieve Maatregelen	Zandzakken dienen maximaal voor de helft te worden gevuld Hoe moet ik een zandzak vullen?	Er zijn 700 zandzakken nodig voor een dijk van 10 meter lengte en 60 cm hoogte Hoeveel zandzakken heb ik nodig?	De verhouding tussen hoogte en breedte van een zandzakdijk is 1 op 3 Wat is de breedte/hoogte verhouding van een zandzakdijk?	Zandzakken moeten worden aangestampt voordat de volgende zandzak er bovenop wordt gelegd Bijzonderheden bij het bouwen van een zandzakdijk	Met 3 (dompel)pompen is een ligbad in 1 minuut leeggepompt Kan ik (dompel)pompen inzetten?	Houten of metalen waterschotten worden op hun plaats gehouden door het plaatsen van zandzakken aan de waterzijde Hoe plaats ik waterschotten in deuropeningen?	Ventilatieopeningen in muren dienen afgedicht te worden met bijvoorbeeld houten platen en purschuim Hoe houdt ik water buiten de deur?
Preventieve Evacuatie	Politie en leger zullen het	Evacuatieroutes worden met	Filevorming wordt met een faktor 3	Verkeersregelaars worden ingezet op	Wanneer een dijk op doorbreken	De (lokale) overheid beslist of	Nee, sommige uitvalswegen

	geevacueerde gebied intensief bewaken	borden aangegeven	teruggedrongen, omdat inwoners gefaseerd worden geevacueerd	drukke verkeersknooppunten in het bedreigde gebied	staat resteert er 6 tot 12 uur om het gebied te verlaten	evacuatie verplicht is of sterk wordt aangeraden	lopen binnen enkele uren na dijkdoorbraak onder water
	Is mijn woning veilig als ik geevacueerd ben?	Hoe kan ik het bedreigde gebied verlaten?	Loop ik extra risico wanneer ik in een file kom te staan en de dijk op dat moment doorbreekt?	Hoe wordt de evacuatie in goede banen geleid?	Hoeveel tijd heb ik om te evacueren?	Is evacuatie verplicht?	Kan ik zelf mijn route uit het gebied bepalen?

Heeft u zich voldoende geinformeerd? Zo ja, ga dan naar de volgende pagina.

De volgende vragen gaan over een woning waar de rivierdijk op doorbreken staat door hoge rivierwaterstanden.
Geef aan hoe groot of klein u de kans acht dat u de onderstaande beschermende maatregelen zou treffen.

1. Kans is heel klein
2. Kans is klein
3. Kans is niet klein/niet groot
4. Kans is groot
5. Kans is heel groot

1) Gezinsleden evacueren
2) Het plaatsen van zandzakken rondom het huis
3) Het gebruik van waterpompen
4) Huisdieren evacueren
5) Het plaatsen van waterschotten in bijvoorbeeld deuropeningen
6) Uzelf evacueren
7) De inboedel naar een veilige plek brengen

De volgende vragen gaan over een woning waar de rivierdijk op doorbreken staat door hoge rivierwaterstanden.
In hoeverre verwacht u de onderstaande gevoelens te ervaren?

1. Helemaal niet
2. Nauwelijks
3. Behoorlijk
4. Erg

5. Heel erg

1) Bang zijn dat bezit (inboedel/woning) schade zou kunnen oplopen?
2) **Zorgen maken dat gezondheidsschade opgelopen zou worden in de woning?**
3) **Zorgen maken dat bezit (inboedel/woning) schade zou kunnen oplopen?**
4) **Bang zijn dat gezondheidsschade opgelopen zou worden in de woning?**

De volgende vragen gaan over een woning in een diepliggende polder waar geen beschermende maatregelen getroffen zijn.
Geef aan hoe klein of groot u de kans acht dat een dijkdoorbraak onderstaande gevolgen zal hebben

1. Kans is heel klein
2. Kans is klein
3. Kans is niet klein/niet groot
4. Kans is groot
5. Kans is heel groot

1) Waterschade aan uw inboedel
2) Waterschade aan de woning
3) Schade aan de gezondheid van huisdieren, familieleden, en uzelf

De volgende vragen gaan over een woning in een diepliggende polder waar geen beschermende maatregelen getroffen zijn.
Hoe ernstig schat u de onderstaande optredende gevolgen in?

1. Helemaal niet ernstig
2. Niet erg ernstig
3. Behoorlijk ernstig
4. Ernstig
5. Zeer ernstig

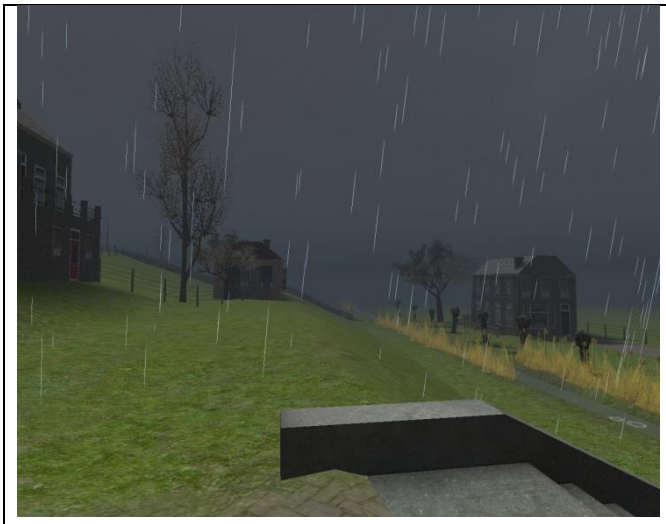
1) Waterschade aan inboedel

2) Waterschade aan de woning

3) Schade aan de gezondheid van huisdieren, familieleden, en uzelf

De situaties voor en na een denkbeeldige dijkdoorbraak staan hieronder nogmaals afgebeeld

situatie voor dijkdoorbraak



situatie na bereiken maximale waterstand

De volgende vragen gaan over een woning in een diepliggende polder, bij een dijkdoorbraak. In welke mate zouden de onderstaande maatregelen helpen om, water(schade) aan bezittingen (inboedel/woning) en gezondheid te voorkomen of te verminderen?

1. Helemaal niet effectief
2. Nauwelijks effectief
3. Redelijk effectief
4. Erg effectief
5. Heel erg effectief

1) **Gezinsleden evacueren**
2) **Het gebruik van waterpompen**
3) **Het plaatsen van zandzakken rondom het huis**
4) **Huisdieren evacueren**
5) **Uzelf evacueren**
6) **Het plaatsen van waterschotten in bijvoorbeeld deuropeningen**
7) **De inboedel naar een veilige plek brengen**

Instructie

De volgende vragen gaan over uw gevoelens en gedachten die u kunt hebben ten aanzien van dijkdoorbraken in het Nederlands rivierengebied.

U kunt uw antwoord aangeven door met de linker muisknop een antwoord aan te klikken
Besteed niet te veel tijd per vraag. Uw eerste ingeving is meestal de beste. Er zijn geen goede of foute antwoorden.

Geef aan in hoeverre u op dit moment onderstaande gevoelens ervaart ten aanzien van dijkdoorbraken in het Nederlands rivierengebied.

1. Helemaal niet
2. Nauwelijks
3. Behoorlijk
4. Erg
5. Heel erg

1) Bang zijn dat uw bezit (inboedel/woning) in het echt schade zal oplopen?
2) Bang zijn voor de regionale gevolgen van dijkdoorbraken in het Nederlands rivierengebied (bv. materiële schade, slachtoffers)?
3) Zorgen maken dat uw bezittingen (inboedel/woning) in het echt schade zal oplopen?
4) Bang zijn dat u gezondheidsschade zal oplopen?
5) Zorgen maken over de regionale gevolgen van dijkdoorbraken in het Nederlands rivierengebied (bv. materiële schade, slachtoffers)?
6) Zorgen maken dat u gezondheidsschade zal oplopen?
7) Verwondering voelen over de kracht van water

De volgende vragen gaan over het Nederlands rivierengebied in het algemeen. Geef aan hoe groot of klein u de kans acht dat dijkdoorbraken onderstaande gevolgen zullen hebben als u of de overheid verder geen beschermende maatregelen zouden treffen

1. Heel klein
2. Klein
3. Niet klein/niet groot
4. Groot
5. Heel groot

1) Waterschade aan uw echte inboedel
2) Materiële schade aan huizen, bedrijven en gewassen in overstroomde gebieden
3) Waterschade aan uw echte woning
4) Dodelijke slachtoffers in overstroomde gebieden
5) Schade aan uw gezondheid
6) Verdrinken van vee (bv. paarden/koeien/schapen) in overstroomde gebieden

Hoe ernstig schat u de onderstaande optredende gevolgen in, wanneer de dijken in het

Nederlands rivierengebied doorbreken en u of de overheid verder geen beschermende maatregelen zouden treffen?

1) **Waterschade aan uw echte inboedel**
    1. Helemaal niet ernstig
    2. Nauwelijks ernstig
    3. Behoorlijk ernstig
    4. Ernstig
    5. Zeer ernstig
2) **Hoogte van materiële schade aan huizen, bedrijven en gewassen in overstroomde gebieden**
    1. < 1 miljoen euro
    2. 1 tot 10 miljoen euro
    3. 10 tot 100 miljoen euro
    4. 100 tot 1000 miljoen euro
    5. > 1000 miljoen euro
3) **Waterschade aan uw echte woning**
    1. Helemaal niet ernstig
    2. Nauwelijks ernstig
    3. Behoorlijk ernstig
    4. Ernstig
    5. Zeer ernstig
4) **Aantal dodelijke slachtoffers in overstroomde gebieden**
    1. Geen doden
    2. 1 tot 10 doden
    3. 10 tot 100 doden
    4. 100 tot 1000 doden
    5. > 1000 doden
5) **Schade aan uw gezondheid**
    1. Helemaal niet ernstig
    2. Nauwelijks ernstig
    3. Behoorlijk ernstig
    4. Ernstig
    5. Zeer ernstig
6) **Aantal stuks verdronken vee in overstroomde gebieden**
    1. Nul stuks vee
    2. 1 tot 10 stuks vee
    3. 10 tot 100 stuks vee
    4. 100 tot 1000 stuks vee
    5. > 1000 stuks vee

Geef aan in hoeverre u onderstaande individuele maatregelen zinvol vindt om de persoonlijke gevolgen van dijkdoorbraken in het Nederlands rivierengebied (bv. materiele schade) te voorkomen of te verminderen.

1. Helemaal niet zinvol
2. Nauwelijks zinvol
3. Behoorlijk zinvol
4. Erg zinvol
5. Heel erg zinvol

1) Niet gaan of blijven wonen in diepliggende polders
2) Het afsluiten van een overstromingsverzekering voor 25 euro per jaar wanneer dit mogelijk zou zijn

Geef aan in hoeverre u onderstaande collectieve maatregelen zinvol vindt om de regionale gevolgen van dijkdoorbraken in het Nederlands rivierengebied (bv. materiele schade) te voorkomen of te verminderen door de huidige rivieren meer ruimte te geven.

1. Helemaal niet zinvol
2. Nauwelijks zinvol
3. Behoorlijk zinvol
4. Erg zinvol
5. Heel erg zinvol

1) Landelijke verhoging van de gemeentelijke belasting (bv. via de waterschapsheffing), waarmee rivieren verder kunnen worden verdiept en verbreed
2) Het graven van zogenaamde 'groene rivieren' door dunbevolkte gebieden waardoor de afvoercapaciteit over meerdere rivieren wordt verdeeld en de maximale waterstand wordt verlaagd

Geef aan hoe groot of klein u de kans acht dat u onderstaande individuele maatregelen in de toekomst zult treffen om de persoonlijke gevolgen van dijkdoorbraken in het Nederlands rivierengebied (bv. materiele schade) tegen te gaan.

1. Heel klein
2. Klein
3. Niet klien/niet groot
4. Groot
5. Heel groot

1) Niet gaan of blijven wonen in diepliggende polders
2) Het afsluiten van een overstromingsverzekering voor 25 Euro per jaar wanneer dit mogelijk zou zijn

Geef aan hoe groot of klein u de kans acht dat u onderstaande collectieve maatregelen in de toekomst zult steunen (bv. via een referendum) om de regionale gevolgen van dijkdoorbraken in het Nederlands rivierengebied (bv. materiele schade) tegen te gaan door de huidige rivieren meer ruimte te geven.

1. Heel klein
2. Klein
3. Niet klien/niet groot
4. Groot
5. Heel groot

1) Landelijke verhoging van de gemeentelijke belasting (bv. via de waterschapsheffing), waarmee rivieren verder kunnen worden verdiept en verbreed
2) Het graven van zogenaamde 'groene rivieren' door dunbevolkte gebieden waardoor de afvoercapaciteit over meerdere rivieren wordt verdeeld en de maximale waterstand wordt verlaagd

Bedankt!

Bedankt voor het meedoen aan dit experiment.

U bent nu klaar met deze vragenlijst. Roep de experiment leider.

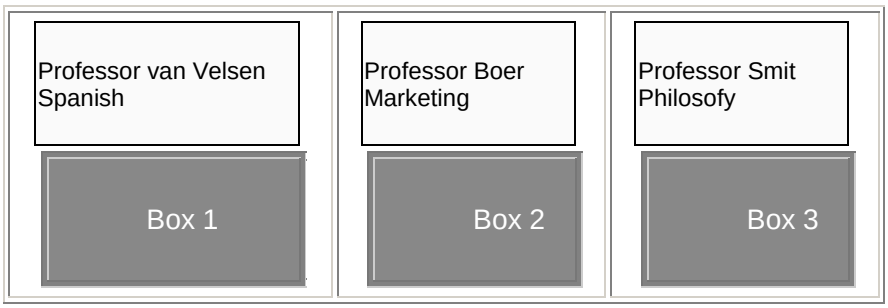
6.6.2 English

Practice task for searching for information

In this practice task you are taught to search for information.

The information is hidden behind boxes. You can search for information by moving the cursor (the arrow) over a box. The box will then open and you can look at the information, until you move the cursor outside of the box.

This practice task is designed to make you accustomed to moving the cursor in and out of the box to view information. Behind every box is hidden information about a course and its respective teacher. Look at the information behind the 3 boxes, answer the accompanied question and continue to the next assignment.



Which course does professor Smit give?

- Spanish
- Marketing
- Philosofy

Carefully read the text written below, before doing the assignment

Climate change can cause high water levels in the future. The previously presented flooding simulation showed what the consequences can be for lower laying polders when river dikes breach. At the end of the simulation, the maximum water level was reached. The water flowed as quickly into the lower laying polder as it left the polder elsewhere.

Instruction

Imagine the residence near the river dike, while the river dike is about to breach with high

water levels in the river. Protective measures are meant to prevent or reduce damage to property or health. Look for more information about protective measures in the schema below.
A row in the schema gives information about preventive evacuation in the threatened area. The other row gives information about various protective measures to keep water outside homes (e.g. sand bags and water partitions).
Read all questions in the schema calmly. Then move the cursor (the arrow) over the questions you'd like to read the answer to. Answers will stay visible as long as you stay on the question-box with your cursor.
As soon as you informed yourself satisfactory, go to the next page where you will indicate which specific measures you think are most fit for the above described residence where the river dike is about to breach because of high water levels in the river.

Preventive Measures	Sandbags should be filled half at max. How can I fill a sandbag?	100 sandbags are needed for a dike of 10 meters in length and 60 cm in height How many sandbags do I need?	The ratio between height and width of a sandbagdike is 1 to 3 What is the height and width ratio for a sandbagdike?	Sandbags have to be stomped before the next sandbag is put on top Special remarks when building a sandbagdike	With 3 (submergible) pumps, a domestic bath can be emptied within 1 minute Can I utilize a (submergible) pump?	Wooden or metal water participants are held in place by moving sandbags to the water-side How can I place water participants in doorways?	Ventilation openings in walls are to be closed with wooden plates or polyurethane foam How can I keep water outside my home?
Preventive Evacuation	Police and army will intensively protect the flooded area	Evacuation routes are shown by signs	Traffic jams are reduced by a factor 3, because residents are evacuated in sections	Traffic controllers are used on busy points in the threatened area	When a dike is about to breach, you have 6 to 12 hours to leave the area	The (local) government decides whether or not evacuation is mandatory or strongly advised	No, some escape routes will submerge within hours after the dike breach

	Is my residence safe when I evacuated?	How can I leave the threatened area?	Do I take extra risks when I am in a traffic jam when a dike breaches at that moment?	How is evacuation properly lead?	How much time do I have to evacuate?	Is evacuation mandatory?	Can I decide my own route outside the threatened area?

Did you inform yourself sufficiently? If yes, go to the next page.

The next questions will be about a residence where a river-dike is about to breach because of high water levels in the river.
Indicate how large or small you think the chance is that you would use the below mentioned protective measures.

1. Chance is very small
2. Chance is small
3. Chance is not small/not large
4. Chance is large
5. Chance is very large

1) Evacuate family members
2) Place sandbags around the house
3) Use water pumps
4) Evacuate pets
5) Place water partitions in e.g. doorways
6) Evacuate yourself
7) Move your furniture to a safe location

The next questions will be about a residence where a river-dike is about to breach because of high water levels in the river.
How much do you expect to experience the following feelings?

1. Not at all
2. Not a lot
3. Quite
4. Very
5. Very much

1) **Scared that your property (furniture/residence) will become damaged?**
2) **Worried that health damage would be acquired inside the residence?**
3) **Worried that property (furniture/residence) will become damaged?**
4) **Scared that health damage would be acquired inside the residence?**

The next questions will be about a residence in a lower laying polder where no protective measures are taken.
Indicate how large you estimate the chance that a dike breach will cause the following consequences

1. Chance is very small

2. Chance is small
3. Chance is not small/not large
4. Chance is large
5. Chance is very large

1) Waterdamage to your furniture
2) Waterdamage to your residence
3) Health damage to your pets, family members and yourself

The next questions will be about a residence in a lower laying polder where no protective measures are taken.
How severe do you estimate the emerging effects below?

6. Not at all severe
7. Not severe
8. Pretty severe
9. Severe
10. Very severe

1) Waterdamage to property

2) Waterdamage to residence

3) Damage to pets', familymembers' and yourself health

The situations before and after the imaginary dike breach are pictured below once more.

situation before the dike breach

situation after reaching the maximum water level

The next questions are about a residence in a lower laying polder, during a dike breach. To what extent would you say the below mentioned coping actions would help to reduce or eliminate water(damage) to belongings (property/residence) and health.

1. Not at all effective
2. Hardly effective
3. Pretty effective
4. Effective
5. Verry effective

1) **Evacuate familymembers**
2) **Using water pumps**
3) **Placing sandbags around the house**
4) **Evacuate pets**
5) **Evacuate yourself**
6) **Placing water partitions in e.g. doorways**
7) **Relocate property to a safe location**

Instruction

The next questions will be about your feelings and thoughts you can have considering dike breaches in the Dutch river area.

U can answer by selecting an answers with the left mousebutton. Don't take too long to answer. Your first answer is usually the best. There are no good or bad answers.

Indicate your current feelings when you think about dike breaches in the Dutch river area.

1. Not at all
2. Not much

3. Reasonable
4. Much
5. Very much

1) Scared that your property (belongings/residence) will become damaged for real?
2) Scared for the regional consequences of dike breaches in the Dutch river area (e.g. material damage, victims)?
3) Worried that your property (belongings/residence) will really become damaged?
4) Scared that your health will be damaged?
5) Worried for the regional consequences of dike breaches in the Dutch river area (e.g. material damage, victims)?
6) Worried that your health will be damaged?
7) Amazed by the power of water?

The following questions will be about the Dutch river area in general. Indicate the how small or large you estimate the chance that dike breaches will have the following consequences when the government does not take protective measures

1. Very small
2. Small
3. Not small/Not large
4. Large
5. Very large

1) Waterdamage to your real property
2) Material damage to homes, companies, crops in flooded areas
3) Waterdamage to your real home
4) Deadly victims in flooded area
5) Damage to your health
6) Downed cattle (horses/cows/etc) in flooded areas

How severe do you estimate the below occurring consequences, when the dikes in the Dutch river area will breach, and when you or the government don't take protective measures?

1) Waterdamage to your real property
   1. Not at all severe
   2. Not really severe
   3. Pretty severe
   4. Severe
   5. Very severe

2) Height of material damage to homes, companies, and crops in the flooded areas
   1. < 1 milion euro
   2. 1 tot 10 milion euro
   3. 10 tot 100 milion euro
   4. 100 tot 1000 milion euro
   5. > 1000 milion euro

3) Waterdamage to your real home
   1. Not at all severe
   2. Not really severe
   3. Pretty severe
   4. Severe

5. Very severe

4) The amount of deadly victims in the flooded areas

1. No deadly victims
2. 1 to 10 deadly victims
3. 10 to 100 deadly victims
4. 100 to 1000 deadly victims
5. > 1000 deadly victims

5) Damage to your health

1. Not at all severe
2. Not really severe
3. Pretty severe
4. Severe
5. Very severe

6) Amount of drowned cattle in flooded areas

1. Zero cattle
2. 1 to 10 cattle
3. 10 to 100 cattle
4. 100 to 1000 cattle
5. > 1000 cattle

Indicate how useful you think the below mentioned individual measures are, to reduce or eliminate the personal consequences of dike breaches in the Dutch river area.

1. Not at all useful
2. Hardly useful
3. Quite useful
4. Useful
5. Very useful

3) Don't move to or stay in lower laying polders

4) Insure yourself for 25 euros per year against floods if possible

Indicate how much you think that the following collective measures will be effective to reduce or eliminate possible regional damages as a consequence of dike breaches in the Dutch river area.

1. Not at all effective
2. Not really effective
3. Pretty effective
4. Effective
5. Very effective

1) National increasing of municipality taxes (e.g. water charge), with which rivers can be deepened and broadened

2) Digging so called 'green rivers' through lightly populated areas and thereby increasing the discharge capacity by dividing water over multiple rivers which decreases the maximum water level.

Indicate how large or small you estimate the chance that you will use the following individual coping actions in the future to counter personal consequences of dike breaches in the Dutch river area (e.g. material damage)

1. Very small

2. Small
3. Not small/Not large
4. Large
5. Very large

1) Don't stay or move to lower laying polders
2) Taking an insurance for 25 euros per year against flooding if possible

Indicate how large or small you estimate the chance that you would support the following collective coping actions to dike breaches in the Dutch river area (e.g. material damage) by giving the current rivers more space.

6. Very small
7. Small
8. Not small/ not large
9. Large
10. Very large

1) **National increasing of municipality taxes (e.g. water charge), with which rivers can be deepened and broadened**
2) **Digging so called 'green rivers' through lightly populated areas and thereby increasing the discharge capacity by dividing water over multiple rivers which decreases the maximum water level.**

Thank you!

Thank you for participating in this experiment.

You are finished with this questionnaire. Call the experiment leader.

6.7 Narratives

6.7.1 Dutch

Tijdens de simulatie zal op verschillende momenten een ander stuk tekst moeten worden aangeroepen in de vorm van een audio file.

1. **Geschreven tekst in de simulatie:** "Bekijk je huis en volg de gele borden."
   Je ziet: Drie huizen op een dijk. Één staat helemaal bovenop de dijk, één in het midden, en één onderaan. Het huis wat de participanten in de simulatie bij Ruud Zaalberg toegewezen kregen was het onderste huis. Het is de bedoeling dat je het trapje waar je op staat op loopt en dan weg op de dijk met aan twee kanten het fietspad naar links loopt. Je ziet aan de andere kant van de dijk dat het water hoog staat, bijna tot aan de weg. Als je de

gele borden volgt kom je langs een uitkijktoren. Daarna loop je de dijk naar beneden en kom je bij een sloot. Achter de sloot zie je bomen.

Tekst Persoonlijk: Wat leuk dat je weer thuis bent! Ik ben Anna, je huisgenoot. Zie je de 3 huizen die aan de rand van de dijk gebouwd zijn? Het onderste huis is waar wij wonen. Het is een super gezellige woning met veel kamers, en niet te duur. We wonen er met 2 andere studenten, Karin en Gerard, en onze huiskat Flip. De eerste verdieping wordt bewoond door Gerard en ik, en jij deelt de begane grond met Karin. Zie je de 4 ramen op de begane grond? De twee ramen het dichtste bij de voordeur zijn van jouw kamer. In het middelste huis, onze buren dus, wonen meneer en mevrouw Bakker, een al iets ouder echtpaar die voor ons de kat eten geven in het weekend. Het schaap dat naast ons huis in de wei staat is ook van hen. Het huis dat bovenaan op de dijk staat is van de familie Jansen. Ze hebben 2 kinderen en een hond. Ze komen weleens op bezoek om appels uit hun tuin te delen met ons. Hun huis ligt aan de weg op de dijk. Deze weg fietsen we altijd samen over naar het station, als we naar de universiteit gaan.

Volg nu de gele borden. Loop tegen het bord aan met het pijltje dat naar beneden wijst.

Tekst Neutraal: Bekijk de huizen. Ze hebben meerdere verdiepingen, waaronder een eerste verdieping en begane grond. Dit is te zien aan de ramen van de woningen. Alle huizen zijn bewoond, soms zijn er ook huisdieren. De bij de dijk gelegen huizen zijn onderdeel van een dorp. De boom naast het bovenste huis is een appelboom. De weg op de dijk wordt gebruikt door fietsers en automobilisten en voert naar de stad. De weg op de dijk is van asfalt en er mag met een snelheid van 60 kilometer per uur op worden gereden.

Volg nu de gele borden. Loop tegen het bord aan met het pijltje dat naar beneden wijst.

2. **Geschreven tekst in de simulatie:** "Kijk hoe de sloot vol zand loopt. Ga daarna naar het rode bord achter je."

   Je ziet: De sloot gaat borrelen rechts van het paaltje waar je bij staat. Daarna komt er zand in de sloot. Het zand zal verder omhoog komen tot dat het de sloot aardig gevuld heeft. Daarna loop je omhoog naar halverwege de dijk.

Tekst Persoonlijk: Kijk! De sloot loopt vol zand! Ik denk niet dat het veel goeds voorspelt. We waren gisteren hier om kikkervisjes te vangen samen. Ik denk niet dat die kikkervisjes het overleven met al dat zand. Wat denk jij dat er gaat gebeuren?

Ga nu naar het rode bord achter je en loop er tegen aan.

Tekst Neutraal: Kijk hoe de sloot vol zand loopt. Dit voorspelt niet veel goeds, ook niet voor de fauna in de sloot. Wat zal er gaan gebeuren?

Ga nu naar het rode bord achter je en loop er tegen aan.

3. **Geschreven tekst in de simulatie:** "Kijk naar de gevolgen voor de dijk. Volg daarna de rode borden terug naar huis."

   Je ziet: De grond van de dijk zakt langzaam in. Het water begint over de dijk te stromen. Daarna spuit het water in een snel tempo de polder in. Als je lang op dezelfde locatie blijft staan halverwege de dijk sta je straks in het water. De polder loopt helemaal vol. Als je omhoog loopt dan kan je aan je rechterkant de volgelopen polder zien.

Tekst Persoonlijk: Oh nee! De dijk verzakt helemaal. Het fietspad is helemaal weggevaagd, hoe komen we nog bij het station? Laten we maar snel terug naar huis gaan. Het lijkt wel of het hele gebied achter de dijk volstroomt met water. Ik hoop dat onze spullen en onze huiskat, Flip, nog veilig zijn, die zat opgesloten in de keuken. Ga nu snel terug naar huis om te kijken.

Tekst Neutraal: De dijk verzakt. De weg is hierdoor verdwenen en kan nu niet meer gebruikt worden. Het gebied achter de dijk is helemaal vol gestroomd met water. Ga kijken wat voor effect dit heeft gehad op de huizen bij het beginpunt en wat er mogelijk in deze huizen te vinden is.

4. **Geschreven tekst in de simulatie:** "Bekijk je huis."

   Je ziet: Eenmaal bij je huis aangekomen zie je dat het onderste huis tot en met de eerste verdieping onder water staat. Het tweede huis heeft alleen water op de onderste verdieping, en het bovenste huis is nog droog.

Tekst Persoonlijk: Het is zo snel gegaan! Ons huis staat helemaal onder water! Denk je dat Karin en Gerard, onze huisgenoten, nog op tijd naar buiten gekomen zijn? Het lijkt wel of de keuken helemaal onder water staat! Ik vrees voor het leven van onze kat. Zou hij ontsnapt zijn? Of….? Ik kan het schaap van de buren ook nergens meer bekennen. De wei is

helemaal onder water verdwenen. Hoe zou het met meneer en mevrouw Bakker zijn? Zouden ze nog in het huis zijn? Zijn ze wel okee? Ons huis is er wel echt slecht aan toe. Zo te zien staat heel je kamer onder water. En mijn nieuwe laptop!

<korte pauze> Dit is het einde van de simulatie, ga nu terug naar de computer om de vragenlijst in te vullen.

Tekst Neutraal: Zoals te zien is zijn de huizen die beschermd werden tegen het water onder gelopen. De bewoners hadden niet lang de tijd om te evacueren. Het huis onderaan de dijk heeft de meeste schade opgelopen. Kijk hoe hoog het water staat. Het ondergelopen gebied is nu moeilijk begaanbaar. Doordat de wegen ook onder water staan is het belangrijk om voort te bewegen door middel van een bootje.

<korte pauze> Dit is het einde van de simulatie, ga nu terug naar de computer om de vragenlijst in te vullen.

6.7.2 English

During the simulation, a different text will be played from an audiofile on specified moments.

1. **Written text in the simulation:** "Look at your house and follow the yellow signs."
   You see: Three houses on a dike. One is at the top of the dike, one in the middle, and one at the bottom. The house where the participants 'lived' in Ruud Zaalberg's simulation was the bottom house. You have to walk up the stairs where you start on and walk on the dike to the left, on which a road and cycling road are shown. You see very high levels of water at the other side of the dike. When you follow the yellow signs, you pass a watch tower. After that, the you walk down the dike and reach a ditch. Behind the ditch are trees.

Text Personal: How nice to see that you're home again! I am Anna, your roommate. Can you see the 3 houses at the side of the dike? The lowest house is where we live. Our house is super cosy with a lot of rooms, and not too expensive. We live there with 2 other students, Karin and Gerard, and our house-cat Flip. The first floor is inhabited by Gerard and me, and you share the ground floor with Karin. Do you see the 4 windows on the ground floor? The two windows closest to the front door are your room's. In the middle house, our neighbours, mister and madam Bakker live, they are an eldery couple who feed our cat during

the weekends. The sheep that is in the meadow next to our house is theirs. The home at the top of the dike is owned by the Jansen family. They have 2 children and a dog. They sometimes visit is to share apples from their garden with us. Their house is right next to the road on the dike. We usually cycle over this road towards the station, when we go to the university.

Now follow the yellow signs. Bump into the sign with the arrow that points down.

Text Neutral: View the houses. They have multiple floors, including a first and ground floor. This can be seen from the windows of the houses. All houses are inhabited, some have pets. The near the dike laying houses are part of a village. The tree next to the top house is an apple tree. The road on the dike is used by cyclers and car drivers, and leads to the city. The road on the dike is made from asphalt, and one can drive there with a 60 kilometre per hour speed.

Now follow the yellow signs. Bump into the sign with the arrow that points down.

2. **Written text in the simulation:** "Watch how the Ditch fills up with sand. Then go to the red sign behind you."

   You see: Bubbles appear in the dutch right of the sign. Then, sand appears in the ditch. The sand will rise until the ditch is quite filled. Then, you walk to halfway up the dike.

Text Personal: Look! The fitch fills up with sand! I think that it doesn't mean good news. Yesterday we were here to catch baby frogs. I don't think those baby frogs will survive with all that sand. What do you think will happen?

Now go to the red sign behind you and bump into it.

Text Neutral: Watch how the ditch fills up with sand. This doesn't mean good news, also for the fauna in the ditch. What will happen?

Now go to the red sign behind you and bump into it.

3. **Written text in the simulation:** "View the consequences for the dike. Then follow the red sign back home."

   You see: The dike slowly sags. Water starts to go over the dike. Then water streams into the polder with a quick pace. If you stay on the same location of the dike for a long time,

your feet will be wet. The polder fills up completely. When you walk up and then look to your right, you can see the flooded polder.

Text Personal: Oh no! The dike is completely sagging! The cycling road is completely wiped out, how can we still get to the station? Let's quickly go back home. It looks like the whole area behind the dike is filling up with water. I hope that our belongings and our house-cat, Flip, are still safe, he was locked up inside the kitchen. Quickly go home to have a look.

Text Neutral: The dike is sagging. Because of this, the road has disappeared and can't be used anymore. The area behind the dike is completely flooded with water. Go and have a look what kind of effect this had on the houses near the starting point, and what possibly had been in these houses.

4. **Written text in the simulation:** "Look at your house."
   You see: When you finally reached your house, you can see that the bottom house has been flooded until the first flood. The second house only has water on the ground floor, and the top house is still dry.

Text Personal: Everything happened so fast! Our house is completely flooded with water! Do you think that Karin and Gerard, our housemates, have gotten out in time? It looks like the kitchen is completely under water! I fear for the life of our cat. Do you think he got away? Or…? I can't see the neighbours' sheep anywhere either. The meadow has completely disappeared under water. How are mister and misses Bakker? Do you think they are still in the house? Are they ok? Our house really looks bad. Your room is completely flooded with water. And my new laptop!

<short break> This is the end of the simulation, go back to the computer to fill in the questionnaire.

Text Neutral: As you can see, the houses which were previously protected against water are flooded. The inhabitants did not have long to evacuate. The house at the bottom of the dike has most damage. Look at how high the water has gotten. The flooded area now is difficult to access. Because the roads are also submerged, it is important to move by means of a boat.

<short break> This is the end of the simulation, go back to the computer to fill in the questionnaire.

7. Virtual Environment Visuals